



15

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of :
Hisashi SHODA et al. :
Appln. No.: 10/015,659 : Group Art Unit: 1756
Filed: December 17, 2001 : Examiner: ANGEBRANNNDT, MARTIN J
For: OPTICAL RECORDING MEDIUM

DECLARATION UNDER 37 C.F.R. §1.132

Commissioner for Patents
Alexandria, Virginia 22313-1450

Sir:

I, Hisashi Shoda, declare and state that:

I graduated from Tokyo Institute of Technology, Graduate School of Science and Engineering, Course of Chemistry, and received a Master's Degree in March 1993.

In April of 1993, I was employed by Mitsubishi Chemical Corporation, and since that time I have been engaged in the study of optical information recording medium.

Since April of 2003, I have been employed by Mitsubishi Kagaku Media Co., Ltd., and engaged in the study of optical information recording medium.

I am a co-inventor of the invention described and claimed in the above-named application, and I am familiar with the subject matter disclosed by the application.

In order to demonstrate the unexpected superiority of the present invention, the following experimentation was conducted by me or under my supervision.

EXPERIMENTATION**(1) Preparation of the coated film**

Similarly to Example 2 of the present invention, by use of the compound C of 150 mg, the compound E of 150 mg and octafluoropentanol of 10 ml, a dye solution containing the compounds C, D and E was prepared. By the way, the dye solution was filtered through a filter of pore diameter being 200 mm, but there was no problem about filterability.

This solution was dropped on a polycarbonate substrate similarly to Example 2, and coated by a spin coat method while changing the rotation speeds in such manners of holding for 25 seconds after acceleration until 500 rpm in 0.8 seconds, holding for 23 seconds after acceleration until 2400 rpm in 22.99 seconds, holding for 4 seconds after acceleration until 5000 rpm in 1 second, and dried at 100°C for 30 minutes. Thus, the coated film containing the compounds C, D and E was prepared on the polycarbonate substrate.

(2) Storage stability test

The above mentioned coated film was held for 200 hours under the circumstances of the temperature at 85°C and the moisture of 85% for carrying out the storage stability test. Owing to the storage stability test, the absorbance somewhat decreased, but falling within the range having no problem as the recording layer of the optical information recording medium. As to others, no changes were present, nor crystallization occurred, either.

I declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date: 12/16/03

Name: Hisashi Shoda

Hisashi SHODA

PATENT APPLICATION
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Hisashi SHODA et al.

Appln. No.: 10/015,659

Group Art Unit: 1756

Filed: December 17, 2001

Examiner: ANGEBRANNNDT, MARTIN J

For: OPTICAL RECORDING MEDIUM

STATEMENT

Commissioner for Patents
Alexandria, Virginia 22313-1450

Sir/Madam:

I, Hidetaka Ota, do declare and state that:

I graduated from Osaka University, Faculty of Engineering Science, Department in Chemical Science and Engineering, having received a Master's Degree in March, 1998.

I am presently employed by NGB CORPORATION of Tokyo, Japan and have been so employed since April, 1998.

I understand the Japanese and English languages. The attached English document is an accurate English translation made by me of Japanese Patent Application No. 2000-114611, filed April 17, 2000, upon which the above-identified U.S. patent application claims a priority.

Date : December 15, 2003

Name: _____

Hidetaka Ota



PATENT OFFICE
JAPANESE GOVERNMENT

**This is to certify that the annexed is a true copy of
the following application as filed with this Office.**

Date of Application: **April 17, 2000**

Application Number: **P.2000-114611**

Applicant(s) : **MITSUBISHI CHEMICAL CORPORATION**



[Document Name] Application for patent

[Reference No.] J05113

[Filing Date] April 17, 2000

[Attention] Mr. Commissioner, Patent Office

[International Patent Classification] G11B 7/24

[Title of the Invention] OPTICAL RECORDING MEDIUM

[Number of Claims] 4

[Inventor]

[Address or Residence] c/o MITSUBISHI CHEMICAL CORPORATION YOKOHAMA RESEAECH CENTER, 1000, Kamoshida-cho, Aoba-ku, Yokohama-shi, Kanagawa

[Name] Hisashi Shoda

[Inventor]

[Address or Residence] c/o MITSUBISHI CHEMICAL CORPORATION YOKOHAMA RESEAECH CENTER, 1000, Kamoshida-cho, Aoba-ku, Yokohama-shi, Kanagawa

[Name] Rieko Hata

[Inventor]

[Address or Residence] c/o MITSUBISHI CHEMICAL CORPORATION YOKOHAMA RESEAECH CENTER, 1000, Kamoshida-cho, Aoba-ku, Yokohama-shi, Kanagawa

[Name] Satoru Imamura

[Applicant]

[Identification No.] 000005968
[Name or Appellation] MITSUBISHI CHEMICAL CORPORATION

[Agent]

[Identification No.] 100103997

[Patent Attorney]

[Name or Appellation] Kouji Hasegawa

[Indication of Fee]

[Deposit Account No.] 035035
[Amount] 21000

[List of Filed Articles]

[Article Name]	Specification	1
[Article Name]	Abstract	1
[Need of Proof]	Yes	

[Designation of Document] Specification

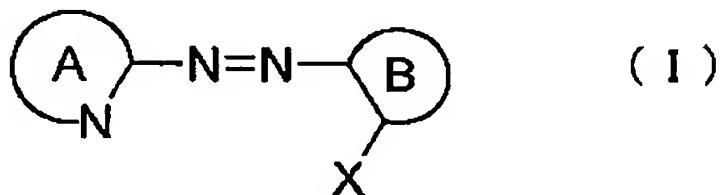
[Title of the Invention]

OPTICAL RECORDING MEDIUM

[Claims]

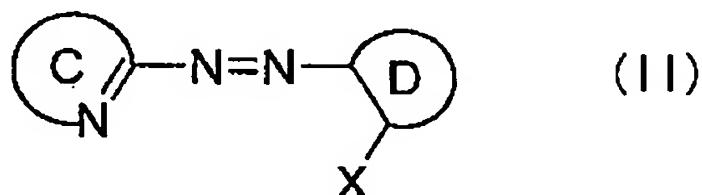
[Claim 1] An optical recording medium comprising a laser-writable and/or readable recording layer provided on a substrate, wherein said recording layer contains a chelate dye comprising two or more azo compounds represented by the following general formula (I) or (II) and a divalent or more metal ion.

[Ka 1]



(wherein ring A represents an aromatic heterocyclic ring which may have substituent(s), ring B represents an aromatic hydrocarbon ring which may have substituent(s) other than X, and X represents a group having an active hydrogen)

[Ka 2]

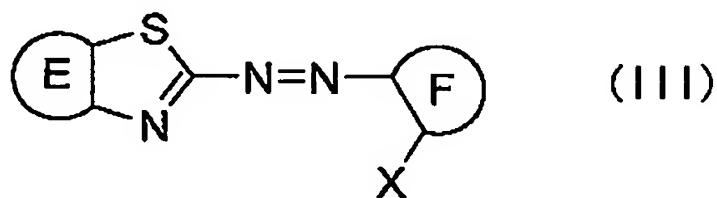


(wherein ring C represents an aromatic heterocyclic ring which may have substituent(s), ring D represents an aromatic hydrocarbon ring which may have substituent(s) other than X, and X represents a group having an active hydrogen)

[Claim 2] The optical recording medium as claimed in claim 1, wherein at least one of ring structures of ring A or ring C and ring B or ring D is different from each other in two or more azo compounds contained in one molecule of the chelate dye.

[Claim 3] The optical recording medium as claimed in claim 1 or 2, wherein two or more azo compounds contained in one molecule of the chelate dye are all represented by the following general formula (III).

[Ka 3]



(wherein ring E represents an aromatic hydrocarbon ring which may have substituent(s) or an aromatic heterocyclic ring which may have substituent(s), ring F represents an aromatic hydrocarbon ring which may have a substituent other than X, and X represents a group having an active hydrogen)

[Claim 4] An optical recording medium, wherein a recording layer comprises a plurality of chelate dyes as claimed in any one of claims 1 to 3.

[Detailed Description of the Invention]

[0001]

[Technical Field to which the Invention Belongs]

The present invention relates to an optical recording medium using a chelate dye comprising azo compounds and a metal in a recording layer.

[0002]

[Prior Art]

Since optical recording using a laser enables high density storing and reproduction of data, the development has been advanced in particular in recent years.

Conventionally proposed optical recording media as the media for use in such recording include a magneto-optical recording medium, a phase-change optical recording medium, a chalcogen-oxidizing optical recording medium, an organic dye optical recording medium, and the like.

[0003]

Of these media, an organic dye optical recording medium has been considered to be superior in view of inexpensiveness and simple manufacturing process.

As an organic dye optical recording medium, a medium wherein a metal layer having high reflectance is

laminated on an organic dye layer has been produced in large quantities as a recordable compact disc (CD-R).

[0004]

As the dyes for use in a recording layer of CD-R, various dyes, e.g., cyanine dyes, phthalocyanine dyes, metal chelate dyes, etc., have been proposed and put to practical use. Focusing on the metal chelate dyes excellent in light fastness and environmental durability, the present inventors have proposed many optical recording media using such kind of dyes, including International Patent Domestic Re-publication No. 818057/1991 and Japanese Patent Laid-Open No. 65514/1994.

[0005]

[Problems that the Invention is to Solve]

Recently, with the development of a high-speed computer, CD-R capable of a high-speed recording 8 times or more faster than previous CD-R has been commercially demanded. The present inventors have already proposed Japanese Patent Application No. 125645/1999 and so forth, and now have newly found an azo metal chelate dye capable of affording an optical recording medium which is applicable to a high-speed recording and has an improved recording sensitivity.

[0006]

[Means for Solving the problems]

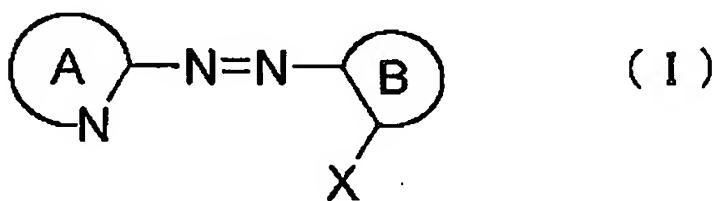
As a result of intensive studies for attaining these objects, the present inventors have found that a satisfactory optical recording medium excellent in recording sensitivity can be obtained by using, in the recording layer, an azo metal chelate dye wherein a plurality of azo compounds having different structures are coordinated to one metal.

[0007]

That is, the present invention relates to an optical recording medium comprising a laser-writable and/or readable recording layer provided on a substrate, wherein the recording layer contains a chelate dye comprising two or more azo compounds represented by the following general formula (I) or (II) and a divalent or more metal ion.

[0008]

[Ka 4]



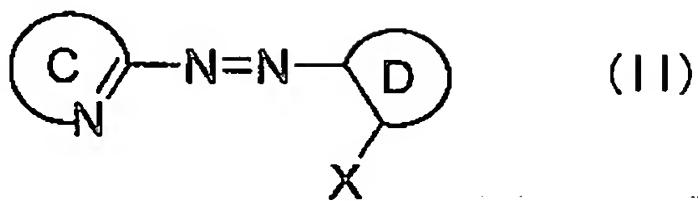
[0009]

(wherein ring A represents an aromatic heterocyclic ring which may have substituent(s), ring B represents an aromatic hydrocarbon ring which may have substituent(s)

other than X, and X represents a group having an active hydrogen);

[0010]

[Ka 5]



[0011]

(wherein ring C represents an aromatic heterocyclic ring which may have substituent(s), ring D represents an aromatic hydrocarbon ring which may have substituent(s) other than X, and X represents a group having an active hydrogen).

[0012]

[Mode for Carrying Out the Invention]

The present invention will be described in detail below.

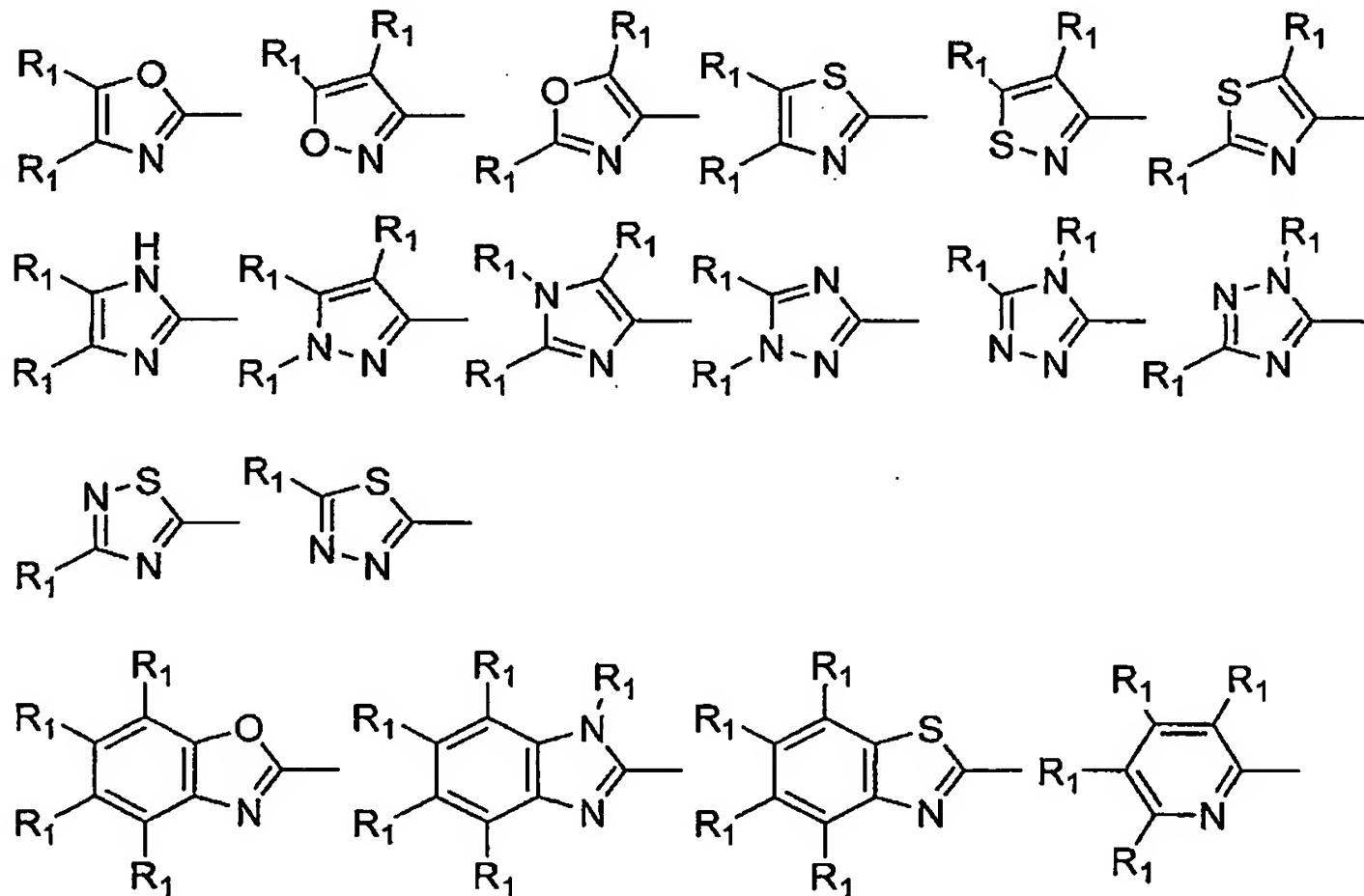
The optical recording medium of the invention wherein an azo metal chelate dye comprising azo compounds and a metal is used in the recording layer has characteristics that light fastness and environmental durability are satisfactory and recording sensitivity is high.

[0013]

In the general formulae (I) and (II), ring A and ring C each is an aromatic heterocyclic ring, and each of these heterocyclic rings may have substituent(s). Ring A and ring C each preferably represents a structure wherein one to three 5-membered ring and/or 6-membered ring are condensed each other. Illustrative examples thereof include the following structures.

[0014]

[Ka 6]



[0015]

All of R_1 in the same ring structure may be the same or different, and each R_1 represents: a hydrogen atom,

a straight chain or branched alkyl group having from 1 to 6 carbon atoms, e.g., methyl group, ethyl group, n-propyl group, isopropyl group, n-butyl group, sec-butyl group, tert-butyl group, n-pentyl group, n-hexyl group,

a cyclic alkyl group having from 3 to 6 carbon atoms, e.g., cyclopropyl group, cyclobutyl group, cyclopentyl group, cyclohexyl group,

an alkoxy group having from 1 to 6 carbon atoms, e.g., methoxy group, ethoxy group, n-propoxy group, isopropoxy group, n-butoxy group, sec-butoxy group, tert-butoxy group, n-pentyloxy group, n-hexyloxy group,

an alkylcarbonyl group having from 1 to 7 carbon atoms, e.g., acetyl group, propionyl group, butyryl group, isobutyryl group, valeryl group, isovaleryl group, pivaloyl group, hexanoyl group, heptanoyl group,

a straight chain or branched alkenyl group having from 2 to 6 carbon atoms, e.g., vinyl group, 1-propenyl group, allyl group, isopropenyl group, 2-butenyl group, 1,3-butadienyl group, 1-pentenyl group, 1-hexenyl group,

a cyclic alkenyl group having from 3 to 6 carbon atoms, e.g., cyclopentenyl group, cyclohexenyl group,

a halogen atom, e.g., fluorine atom, chlorine atom, bromine atom, iodine atom,

a formyl group,

a hydroxyl group,

a carboxyl group,

a hydroxyalkyl group having from 1 to 6 carbon atoms, e.g., hydroxymethyl group, hydroxyethyl group,

an alkoxy carbonyl group having from 2 to 7 carbon atoms, e.g., methoxycarbonyl group, ethoxycarbonyl group, n-propoxycarbonyl group, isopropoxycarbonyl group,

n-butoxycarbonyl group, sec-butoxycarbonyl group, tert-butoxycarbonyl group, n-pentyloxycarbonyl group, n-hexyloxycarbonyl group,

a nitro group,

a cyano group,

an amino group,

an alkylamino group having from 1 to 6 carbon atoms, e.g., methylamino group, ethylamino group, n-propylamino group, n-butyramino group,

a dialkylamino group having from 1 to 12 carbon atoms, e.g., dimethylamino group, diethylamino group, di-n-propylamino group, di-n-butyramino group,

an alkoxy carbonylalkyl group having from 3 to 7 carbon atoms, e.g., methoxycarbonylmethyl group, ethoxycarbonylmethyl group, n-propoxycarbonylmethyl group, isopropoxycarbonylethyl group,

an alkylthio group having from 1 to 6 carbon atoms, e.g., methylthio group, ethylthio group, n-propylthio group, sec-

butylthio group, tert-butylthio group, n-pentylthio group, n-hexylthio group,

an alkylsulfonyl group having from 1 to 6 carbon atoms,

e.g., methylsulfonyl group, ethylsulfonyl group, n-propylsulfonyl group, isopropylsulfonyl group, n-butylsulfonyl group, sec-butylsulfonyl group, tert-butylsulfonyl group, n-pentylsulfonyl group, n-hexylsulfonyl group,

an aryl group having from 6 to 16 carbon atoms which may have substituent(s),

an arylcarbonyl group having from 7 to 17 carbon atoms which may have substituent(s),

[0016]

[Ka 7]

$-\text{CR}_2=\text{C}(\text{CN})\text{R}_3$

(R₂ represents a hydrogen atom or

an alkyl group having from 1 to 6 carbon atoms, e.g., methyl group, ethyl group, n-propyl group, isopropyl group, n-butyl group, sec-butyl group, tert-butyl group, n-pentyl group, n-hexyl group; and

R₃ represents:

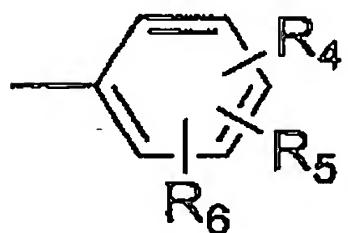
a cyano group or

an alkoxy carbonyl group having from 2 to 7 carbon atoms, e.g., methoxycarbonyl group, ethoxycarbonyl group, n-propoxycarbonyl group, isopropoxycarbonyl group,

n-butoxycarbonyl group, sec-butoxycarbonyl group, tert-butoxycarbonyl group, n-pentyloxycarbonyl group, n-hexyloxycarbonyl group),

[0017]

[Ka 8]



[0018]

(R₄ to R₆ each independently represents:

a hydrogen atom,

a nitro group,

a halogen atom, e.g., fluorine atom, chlorine atom, bromine atom, iodine atom,

a straight chain or branched alkyl group having from 1 to 6 carbon atoms, e.g., methyl group, ethyl group, n-propyl group, isopropyl group, n-butyl group, sec-butyl group, tert-butyl group, n-pentyl group, n-hexyl group,

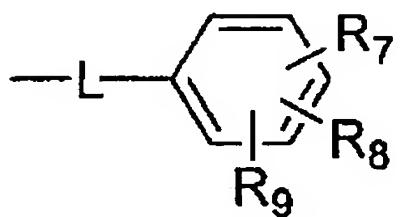
a cyclic alkyl group having from 3 to 6 carbon atoms, e.g., cyclopropyl group, cyclobutyl group, cyclopentyl group, cyclohexyl group,

an alkoxy group having from 1 to 6 carbon atoms, e.g., methoxy group, ethoxy group, n-propoxy group, isopropoxy

group, n-butoxy group, sec-butoxy group, tert-butoxy group, n-pentyloxy group, n-hexyloxy group),

[0019]

[Ka 9]



[0020]

(R₇ to R₉ each independently represents:

a hydrogen atom,

a nitro group,

a halogen atom, e.g., fluorine atom, chlorine atom, bromine atom, iodine atom,

a straight chain or branched alkyl group having from 1 to 6 carbon atoms, e.g., methyl group, ethyl group, n-propyl group, isopropyl group, n-butyl group, sec-butyl group, tert-butyl group, n-pentyl group, n-hexyl group,

a cyclic alkyl group having from 3 to 6 carbon atoms, e.g., cyclopropyl group, cyclobutyl group, cyclopentyl group, cyclohexyl group,

an alkoxy group having from 1 to 6 carbon atoms, e.g., methoxy group, ethoxy group, n-propoxy group, isopropoxy group, n-butoxy group, sec-butoxy group, tert-butoxy group,

n-pentyloxy group, n-hexyloxy group; and L represents -SCH₂- or -SO₃-),

a halogenated alkyl group having from 1 to 6 carbon atoms, e.g., trifluoromethyl group, pentafluoroethyl group, heptafluoro-n-propyl group, heptafluoroisopropyl group, perfluoro-n-butyl group, perfluoro-sec-butyl group, perfluoro-tert-butyl group, perfluoro-n-pentyl group, perfluoro-n-hexyl group,

a halogenated alkoxy group having from 1 to 6 carbon atoms, e.g., trifluoromethoxy group, pentafluoroethoxy group, 2,2,2-trifluoroethoxy group, pentafluoroethoxy group, perfluoro-n-butoxy group, perfluoro-sec-butoxy group, perfluoro-tert-butoxy group, perfluoro-n-pentyloxy group, perfluoro-n-hexyloxy group,

a halogenated alkylthio group having from 1 to 6 carbon atoms, e.g., trifluoromethylthio group, pentafluoroethylthio group, heptafluoro-n-propylthio group, heptafluoroisopropylthio group, perfluoro-n-butylthio group, perfluoro-sec-butylthio group, perfluoro-n-pentylthio group, perfluoro-n-hexylthio group, or the like).

[0021]

Preferable group of the substituent R₁ is a hydrogen atom, an unsubstituted alkyl group, a halogenated alkyl group, an alkylthio group, an unsubstituted alkoxy

group, a halogenated alkoxy group, an alkenyl group, a formyl group, a carboxyl group, an alkylcarbonyl group, an alkoxy carbonyl group, a cyano group, a nitro group or a halogen atom.

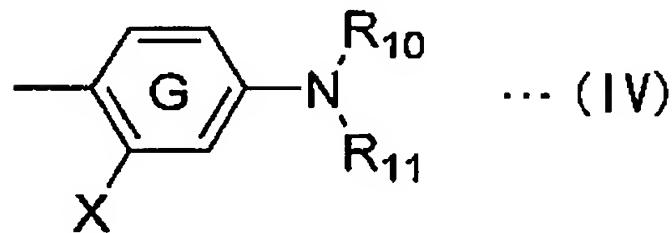
[0022]

Preferable structure of ring A or ring C is a condensed structure of two rings. Particularly preferred is a benzothiazole ring.

In the general formulae (I) and (II), ring B and ring D each is an aromatic hydrocarbon ring and may have substituent(s) other than X. More preferably, ring B and ring D each represents:

[0023]

[Ka 10]



[0024]

In the formula, the benzene ring G may have substituent(s) other than X and NR₁₀R₁₁.

R₁₀ and R₁₁ independently represents:

a hydrogen atom,

a straight chain or branched alkyl group having from 1 to 6 carbon atoms which may have substituent(s), e.g., methyl

group, ethyl group, n-propyl group, isopropyl group, n-butyl group, sec-butyl group, tert-butyl group, n-pentyl group, n-hexyl group,
an aryl group having from 6 to 18 carbon atoms which may have substituent(s), e.g., phenyl group, tolyl group, xylyl group, naphthyl group,
a straight chain or branched alkenyl group having from 2 to 6 carbon atoms, e.g., vinyl group, 1-propenyl group, allyl group, isopropenyl group, 2-butenyl group, 1,3-butadienyl group, 1-pentenyl group, 1-hexenyl group,
a cyclic alkenyl group having from 3 to 6 carbon atoms, e.g., cyclopentenyl group, cyclohexenyl group, or
a cyclic alkyl group having from 3 to 6 carbon atoms which may have substituent(s), e.g., cyclopropyl group, cyclobutyl group, cyclopentyl group, cyclohexyl group.

Such alkyl, aryl, alkenyl, cyclic alkenyl and cyclic alkyl groups may be substituted with:
an alkoxy group having from 1 to 6 carbon atoms, e.g., methoxy group, ethoxy group, n-propoxy group, isopropoxy group, n-butoxy group, sec-butoxy group, tert-butoxy group, n-pentyloxy group, n-hexyloxy group,
an alkoxyalkoxy group having from 2 to 12 carbon atoms, e.g., methoxymethoxy group, ethoxymethoxy group, propoxymethoxy group, methoxyethoxy group, ethoxyethoxy group, propoxyethoxy group, methoxypropoxy group,

ethoxypropoxy group, methoxybutoxy group, ethoxybutoxy group,
an alkoxyalkoxyalkoxy group having from 3 to 15 carbon atoms, e.g., methoxymethoxymethoxy group, methoxymethoxyethoxy group, methoxyethoxymethoxy group, methoxyethoxyethoxy group, ethoxymethoxymethoxy group, ethoxymethoxyethoxy group, ethoxyethoxymethoxy group, ethoxyethoxyethoxy group,
an allyloxy group,
an aryl group having from 6 to 18 carbon atoms, e.g., phenyl, tolyl group, xylyl group, naphthyl group,
an aryloxy group from 6 to 18 carbon atoms, e.g., phenoxy group, tolyloxy group, xylyloxy group, naphthyoxy group,
a cyano group,
a nitro group,
a hydroxyl group,
a tetrahydrofuryl group,
an alkylamino group having from 1 to 6 carbon atoms, e.g., methylamino group, ethylamino group, n-propylamino group, n-butyramino group,
a dialkylamino group having from 1 to 12 carbon atoms, e.g., dimethylamino group, diethylamino group, di-n-propylamino group, di-n-butyramino group,
an alkylsulfonylamino group having from 1 to 6 carbon atoms, e.g., methylsulfonylamino group, ethylsulfonylamino

group, n-propylsulfonylamino group, isopropylsulfonylamino group, n-butylsulfonylamino group, sec-butylsulfonylamino group, tert-butylsulfonylamino group, n-pentylsulfonylamino group, n-hexylsulfonylamino group,

a halogen atom, e.g., fluorine atom, chlorine atom, bromine atom, iodine atom,

an alkoxy carbonyl group having from 2 to 7 carbon atoms, e.g., methoxycarbonyl group, ethoxycarbonyl group, n-propoxycarbonyl group, isopropoxycarbonyl group, n-butoxycarbonyl group, sec-butoxycarbonyl group, tert-butoxycarbonyl group, n-pentyloxycarbonyl group, n-hexyloxycarbonyl group,

an alkylcarbonyloxy group having from 2 to 7 carbon atoms, e.g., methylcarbonyloxy group, ethylcarbonyloxy group, n-propylcarbonyloxy group, isopropylcarbonyloxy group, n-butylcarbonyloxy group, sec-butylcarbonyloxy group, tert-butylcarbonyloxy group, n-pentylcarbonyloxy group, n-hexylcarbonyloxy group,

or the like.

[0025]

Of these R_{10} and R_{11} , particularly preferred is an unsubstituted straight chain or branched alkyl group or an alkyl group substituted with halogen atom(s).

In the general formula (IV), benzene ring G may have substituent(s) other than X and NR₁₀R₁₁, and the substituents include:

a straight chain or branched alkyl group having from 1 to 6 carbon atoms, e.g., methyl group, ethyl group, n-propyl group, isopropyl group, n-butyl group, sec-butyl group, tert-butyl group, n-pentyl group, n-hexyl group, an alkoxy group having from 1 to 6 carbon atoms, e.g., methoxy group, ethoxy group, n-propoxy group, isopropoxy group, n-butoxy group, sec-butoxy group, tert-butoxy group, n-pentyloxy group, n-hexyloxy group, a halogen atom, e.g., fluorine atom, chlorine atom, bromine atom, iodine atom, a cyano group, a nitro group, a hydroxyl group, an alkylsulfonyl group having from 1 to 6 carbon atoms, e.g., methylsulfonyl group, ethylsulfonyl group, n-propylsulfonyl group, isopropylsulfonyl group, n-butylylsulfonyl group, sec-butylylsulfonyl group, tert-butylylsulfonyl group, n-pentylylsulfonyl group, n-hexylsulfonyl group, an alkoxycarbonyl group having from 2 to 7 carbon atoms, e.g., methoxycarbonyl group, ethoxycarbonyl group, n-propoxycarbonyl group, isopropoxycarbonyl group, n-

butoxycarbonyl group, sec-butoxycarbonyl group, tert-butoxycarbonyl group, n-pentyloxycarbonyl group, n-hexyloxycarbonyl group, and a thiocyanato group.

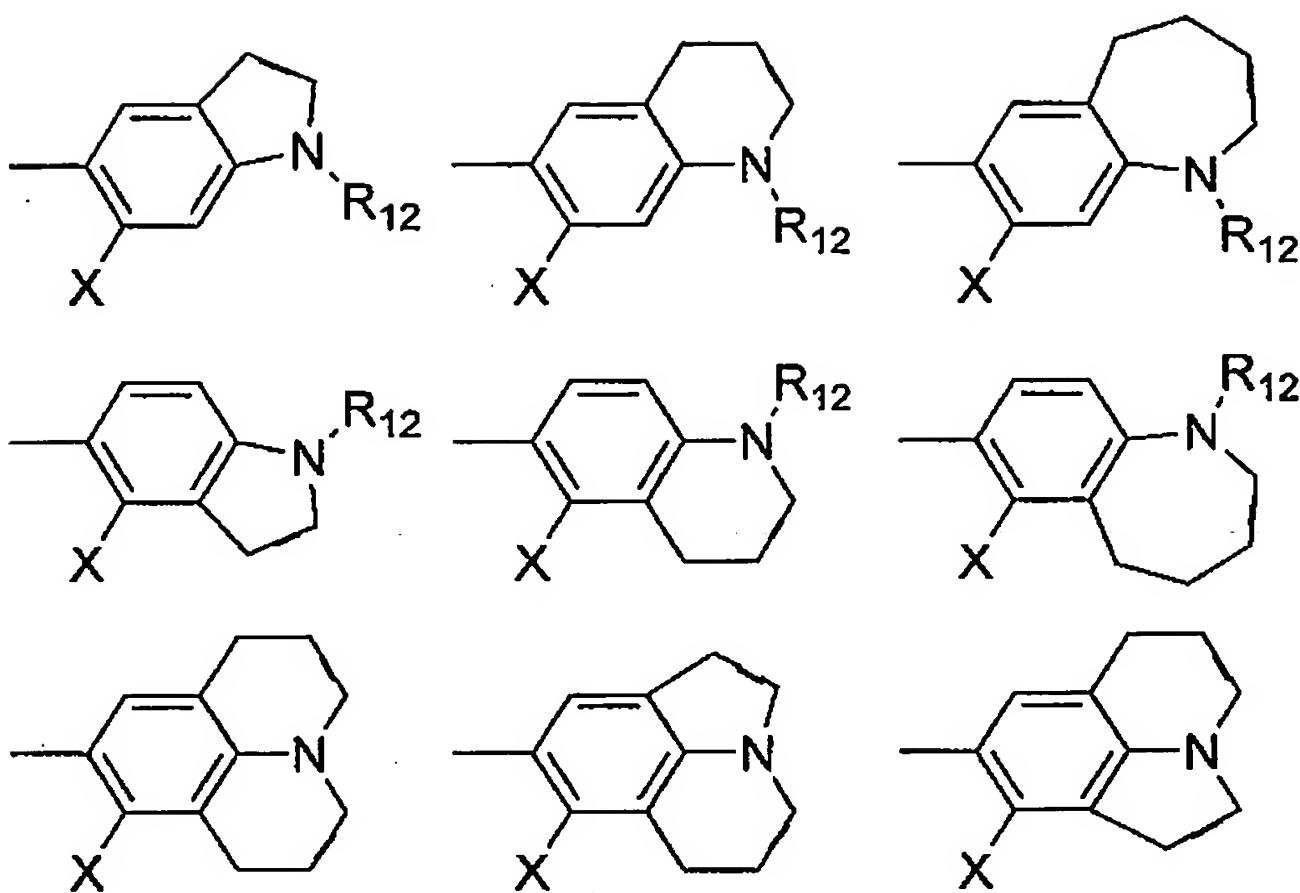
[0026]

As the substituents of the benzene ring G, particularly preferred is an unsubstituted straight chain or branched alkyl group or an unsubstituted alkoxy group.

In the general formula (IV), when R₁₀ and/or R₁₁ form(s) a ring condensed with the benzene ring G, specifically, the following structures may be exemplified.

[0027]

[Ka 11]



[0028]

Substituent *R₁₂* on N represents:

a hydrogen atom,

a straight chain or branched alkyl group having from 1 to 6 carbon atoms which may have substituent(s), e.g., methyl group, ethyl group, n-propyl group, isopropyl group, n-butyl group, sec-butyl group, tert-butyl group, n-pentyl group, n-hexyl group, or

an aryl group having from 6 to 18 carbon atoms which may have substituent(s), e.g., phenyl group, tolyl group, xylyl group, naphthyl group, and preferred is a straight chain or branched alkyl group having from 1 to 6 carbon atoms.

Such alkyl and aryl groups may be substituted with:

an alkoxy group having from 1 to 6 carbon atoms, e.g., methoxy group, ethoxy group, n-propoxy group, isopropoxy group, n-butoxy group, sec-butoxy group, tert-butoxy group, n-pentyloxy group, n-hexyloxy group,

an alkoxyalkoxy group having from 2 to 12 carbon atoms, e.g., methoxymethoxy group, ethoxymethoxy group, propoxymethoxy group, methoxyethoxy group, ethoxyethoxy group, propoxyethoxy group, methoxypropoxy group, ethoxypropoxy group, methoxybutoxy group, ethoxybutoxy group,

an alkoxyalkoxyalkoxy group having from 3 to 15 carbon atoms, e.g., methoxymethoxymethoxy group, methoxymethoxyethoxy group, methoxyethoxymethoxy group, methoxyethoxyethoxy group, ethoxymethoxymethoxy group, ethoxymethoxyethoxy group, ethoxyethoxymethoxy group, ethoxyethoxyethoxy group,

an allyloxy group,

an aryl group having from 6 to 18 carbon atoms, e.g., phenyl group, tolyl group, xylyl group, naphthyl group,

an aryloxy group from 6 to 18 carbon atoms, e.g., phenoxy group, tolyloxy group, xylyloxy group, naphthyloxy group,

a cyano group,

a nitro group,

a hydroxyl group,

a tetrahydrofuryl group,

an alkylamino group having from 1 to 6 carbon atoms, e.g., methylamino group, ethylamino group, n-propylamino group, n-butylamino group,

a dialkylamino group having from 1 to 12 carbon atoms, e.g., dimethylamino group, diethylamino group, di-n-propylamino group, di-n-butylamino group,

an alkylsulfonylamino group having from 1 to 6 carbon atoms, e.g., methylsulfonylamino group, ethylsulfonylamino group, n-propylsulfonylamino group, isopropylsulfonylamino group, n-butylsulfonylamino group, sec-butylsulfonylamino group, tert-butylsulfonylamino group, n-pentylsulfonylamino group, n-hexylsulfonylamino group,

a halogen atom, e.g., fluorine atom, chlorine atom, bromine atom, iodine atom,

an alkoxy carbonyl group having from 2 to 7 carbon atoms, e.g., methoxycarbonyl group, ethoxycarbonyl group, n-propoxycarbonyl group, isopropoxycarbonyl group, n-butoxycarbonyl group, sec-butoxycarbonyl group, tert-butoxycarbonyl group, n-pentyloxycarbonyl group, n-hexyloxycarbonyl group, or

an alkylcarbonyloxy group having from 2 to 7 carbon atoms, e.g., methylcarbonyloxy group, ethylcarbonyloxy group, n-propylcarbonyloxy group, isopropylcarbonyloxy group, n-

butylcarbonyloxy group, sec-butyIcarbonyloxy group, tert-butyIcarbonyloxy group, n-pentylcarbonyloxy group, n-hexylcarbonyloxy group,
or the like.

[0029]

Of these R_{12} , particularly preferred is an unsubstituted straight chain or branched alkyl group, or an alkyl group substituted with halogen atom(s) or alkenyl group(s).

In the case that R_{10} or R_{11} forms a ring condensed with benzene ring in the formula (IV), the size of the ring is preferably a 5- or 6-membered ring, most preferably a 6-membered ring.

The substituents on ring B or ring D other than X and R_{12} include:

a straight chain or branched alkyl group having from 1 to 6 carbon atoms, e.g., methyl group, ethyl group, n-propyl group, isopropyl group, n-butyl group, sec-butyl group, tert-butyl group, n-pentyl group, n-hexyl group,
a cyclic alkyl group having from 3 to 6 carbon atoms, e.g., cyclopropyl group, cyclobutyl group, cyclopentyl group, cyclohexyl group,
an alkoxyl group having from 1 to 6 carbon atoms, e.g., methoxy group, ethoxy group, n-propoxy group, isopropoxy group, n-butoxy group, sec-butoxy group, tert-butoxy group,

n-pentyloxy group, n-hexyloxy group,
an alkylcarbonyl group having from 1 to 7 carbon atoms,
e.g., acetyl group, propionyl group, butyryl group,
isobutyryl group, valeryl group, isovaleryl group, pivaloyl
group, hexanoyl group, heptanoyl group,
a straight chain or branched alkenyl group having from 2 to
6 carbon atoms, e.g., vinyl group, 1-propenyl group, allyl
group, isopropenyl group, 2-butenyl group, 1,3-butadienyl
group, 1-pentenyl group, 1-hexenyl group,
a cyclic alkenyl group having from 3 to 6 carbon atoms,
e.g., cyclopentenyl group, cyclohexenyl group,
a halogen atom, e.g., fluorine atom, chlorine atom, bromine
atom, iodine atom,
a formyl group,
a hydroxyl group,
a carboxyl group,
a hydroxyalkyl group having from 1 to 6 carbon atoms, e.g.,
hydroxymethyl group, hydroxyethyl group,
an alkoxy carbonyl group having from 2 to 7 carbon atoms,
e.g., methoxycarbonyl group, ethoxycarbonyl group, n-
propoxycarbonyl group, isopropoxycarbonyl group, n-
butoxycarbonyl group, sec-butoxycarbonyl group, tert-
butoxycarbonyl group, n-pentyloxycarbonyl group, n-
hexyloxycarbonyl group,
a nitro group,

a cyano group,

an amino group,

an alkylamino group having from 1 to 6 carbon atoms, e.g., methylamino group, ethylamino group, n-propylamino group, n-butylamino group,

a dialkylamino group having from 1 to 12 carbon atoms, e.g., dimethylamino group, diethylamino group, di-n-propylamino group, di-n-butylamino group,

an alkoxy carbonylalkyl group having from 3 to 7 carbon atoms, e.g., methoxycarbonylmethyl group, ethoxycarbonylmethyl group, n-propoxycarbonylmethyl group, isopropoxycarbonylethyl group,

an alkylthio group having from 1 to 6 carbon atoms, e.g., methylthio group, ethylthio group, n-propylthio group, sec-butylthio group, tert-butylthio group, n-pentylthio group, n-hexylthio group,

an alkylsulfonyl group having from 1 to 6 carbon atoms, e.g., methylsulfonyl group, ethylsulfonyl group, n-propylsulfonyl group, isopropylsulfonyl group, n-butyrsulfonyl group, sec-butyrsulfonyl group, tert-butyrsulfonyl group, n-pentylsulfonyl group, n-hexylsulfonyl group,

an aryl group having from 6 to 16 carbon atoms which may have substituent(s),

an arylcarbonyl group having from 7 to 17 carbon atoms

which may have substituent(s),
and the like.

[0030]

Of these substituents on ring B or ring D, particularly preferred is an unsubstituted straight chain or branched alkyl group or an alkyl group substituted with halogen atom(s).

The chelate dye of the invention is a dye wherein two or more azo compounds represented by the general formula (I) or (II) are coordinated to one metal. It is preferred that at least one of ring structures of ring A or ring C and ring B or ring D contained in the plurality of azo compounds is different from each other. The "ring structure" herein means the skeletal ring in each of ring A to ring D (substituents are not included).

[0031]

That is, in the combination of two kinds of the general formula (I) or (II), it means a combination satisfying at least any of a combination of different ring structures of A, a combination of different ring structures of C, a combination of a ring structure of A and a ring structure of C, a combination of different ring structures of B, a combination of different ring structures of D, and a combination of a ring structure of B and a ring structure of D. By the way, the chelate dye of the invention may be

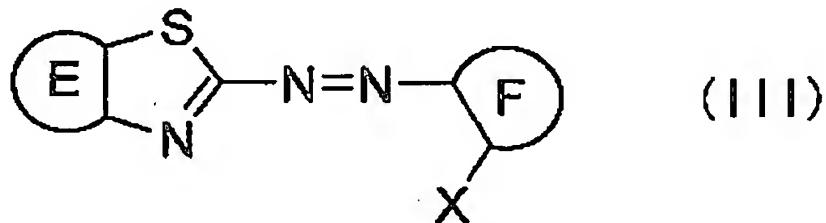
a dye satisfying two or more of the above combinations.

[0032]

The particularly preferred is a combination of two or more azo compounds represented by the general formula (II) and wherein every ring C is a condensed ring containing thiazole, i.e., a chelate dye having two or more of the azo compounds represented by the general formula (III):

[0033]

[Ka 12]



[0034]

(wherein ring E represents an aromatic hydrocarbon ring which may have substituent(s) or an aromatic heterocyclic ring which may have substituent(s), ring F represents an aromatic hydrocarbon ring which may have substituent(s) other than X, and X represents a group having an active hydrogen) in one molecule of the chelate dye (ring F in each azo compound may not have the same ring structure). It is most preferable that both of the condensed rings containing a thiazole ring are each benzothiazole.

[0035]

In the general formulae (I) and (II), X represents a group having active hydrogen including, e.g., -SH, -SO₂H, -SO₃H, -NH₂, -NHR₁₃, -OH, -CO₂H, -B(OH)₂, -PO(OH)₂, -NHCOH, -NHCOR₁₃, and -NHSO₂R₁₃. Of these, preferred are -SO₃H, -NH₂, -NHR₁₃, -OH, -CO₂H, -NHCOH, -NHCOR₁₃, and -NHSO₂R₁₃, and particularly preferred are -SO₃H, -CO₂H, -OH, and -NHSO₂R₁₃.

[0036]

Therein, R₁₃ represents a straight chain or branched alkyl group having from 1 to 6 carbon atoms which may have substituent(s), e.g., methyl group, ethyl group, n-propyl group, isopropyl group, n-butyl group, sec-butyl group, tert-butyl group, n-pentyl group, n-hexyl group, or a phenyl group which may have substituent(s) having from 6 to 12 carbon atoms, e.g., phenyl group, tolyl group, xylyl group, naphthyl group, and these groups may be substituted with halogen atom(s), e.g., fluorine atom, chlorine atom, bromine atom, iodine atom.

[0037]

The metal which constitutes the chelate dye in the invention is not particularly restricted as long as it may be divalent or more. The "metal" used herein means a metal positioned on the left side of the line connecting boron and astatine in the long form of the Periodic Table, i.e., group I except hydrogen (alkali metal and the copper group), group II (alkaline earth metal and the zinc group),

group III except boron, group IV except carbon and silicon, group VIII (the iron group and the platinum group), elements belonging to each subgroup a of groups V, VI and VII, antimony, bismuth, and polonium (cf. Rikagaku Jiten, 3rd Ed., enlarged edition, p. 339, Iwanami Shoten Co., Ltd.). Preferred is Mg, Al, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Zr, Ru, Rh, Pd, In, Sn, Hf, Os, Pt, or Hg, and, of these, Co, Ni, Cu, or Pd is particularly preferred.

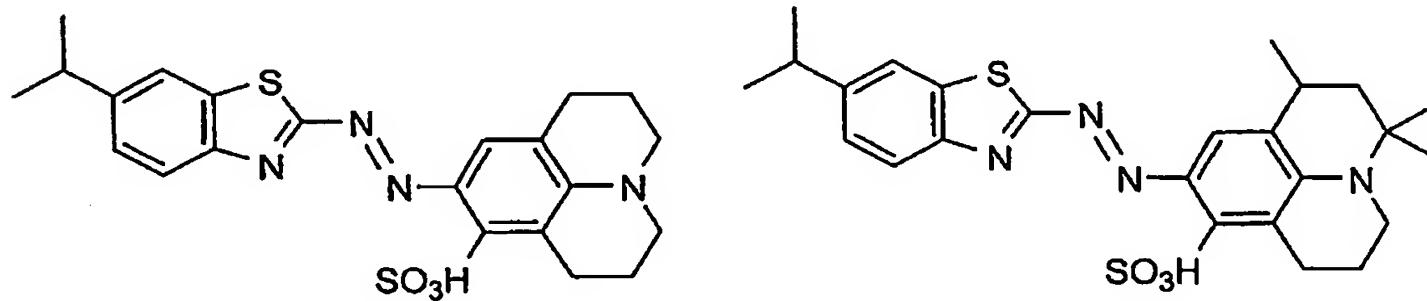
[0038]

The specific examples of the azo metal chelate dye of the invention formed from an azo compound and a metal include the following.

By the way, in the following specific examples, for example, a chelate dye formed by the following two kinds of azo dyes:

[0039]

[Ka 13]

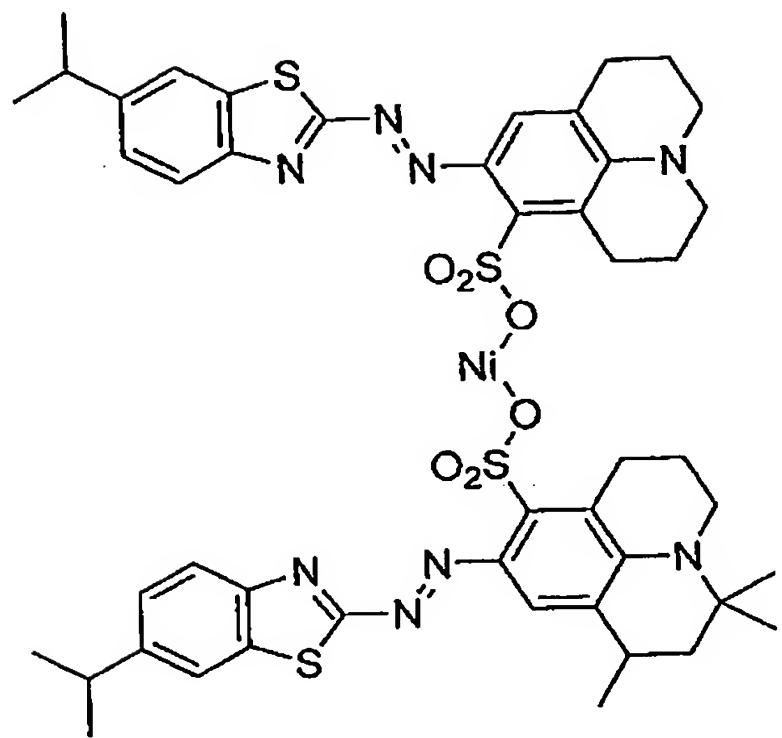


[0040]

and Ni is represented as follows:

[0041]

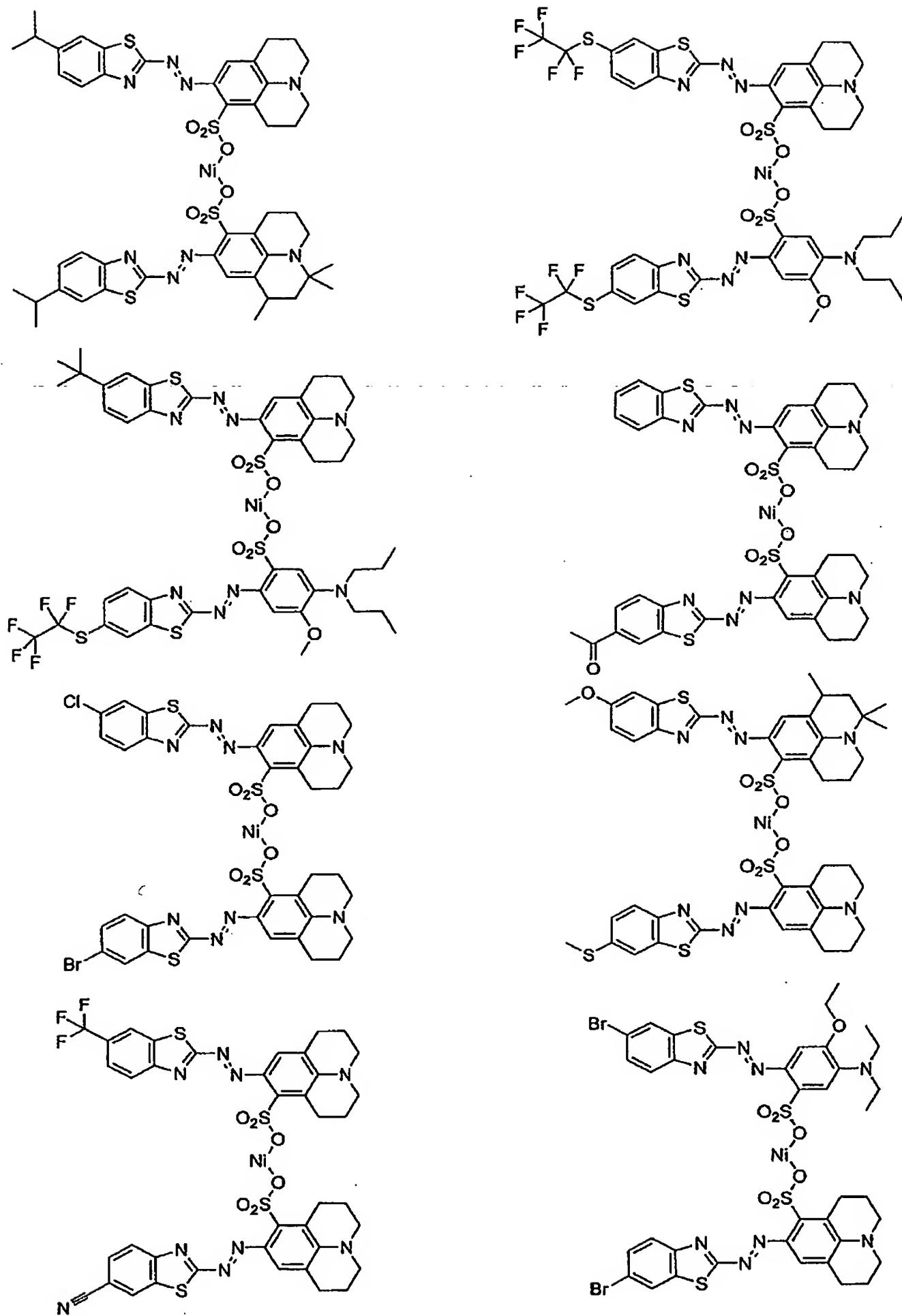
[Ka 14]



[0042]

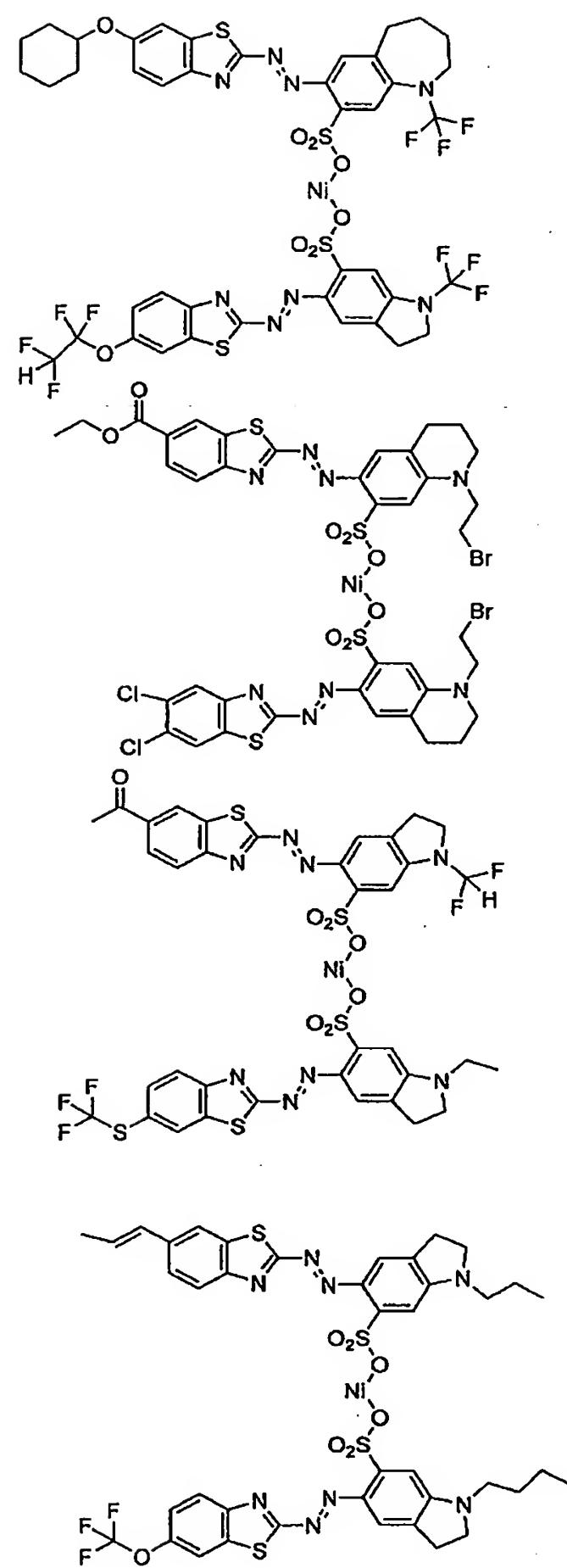
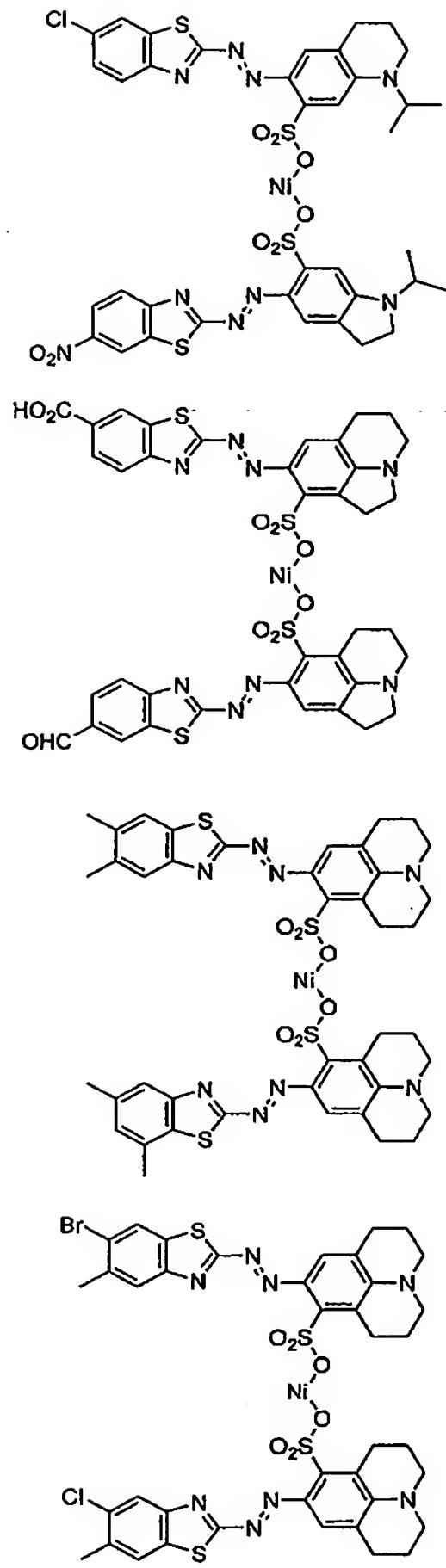
[0043]

[Ka 15]



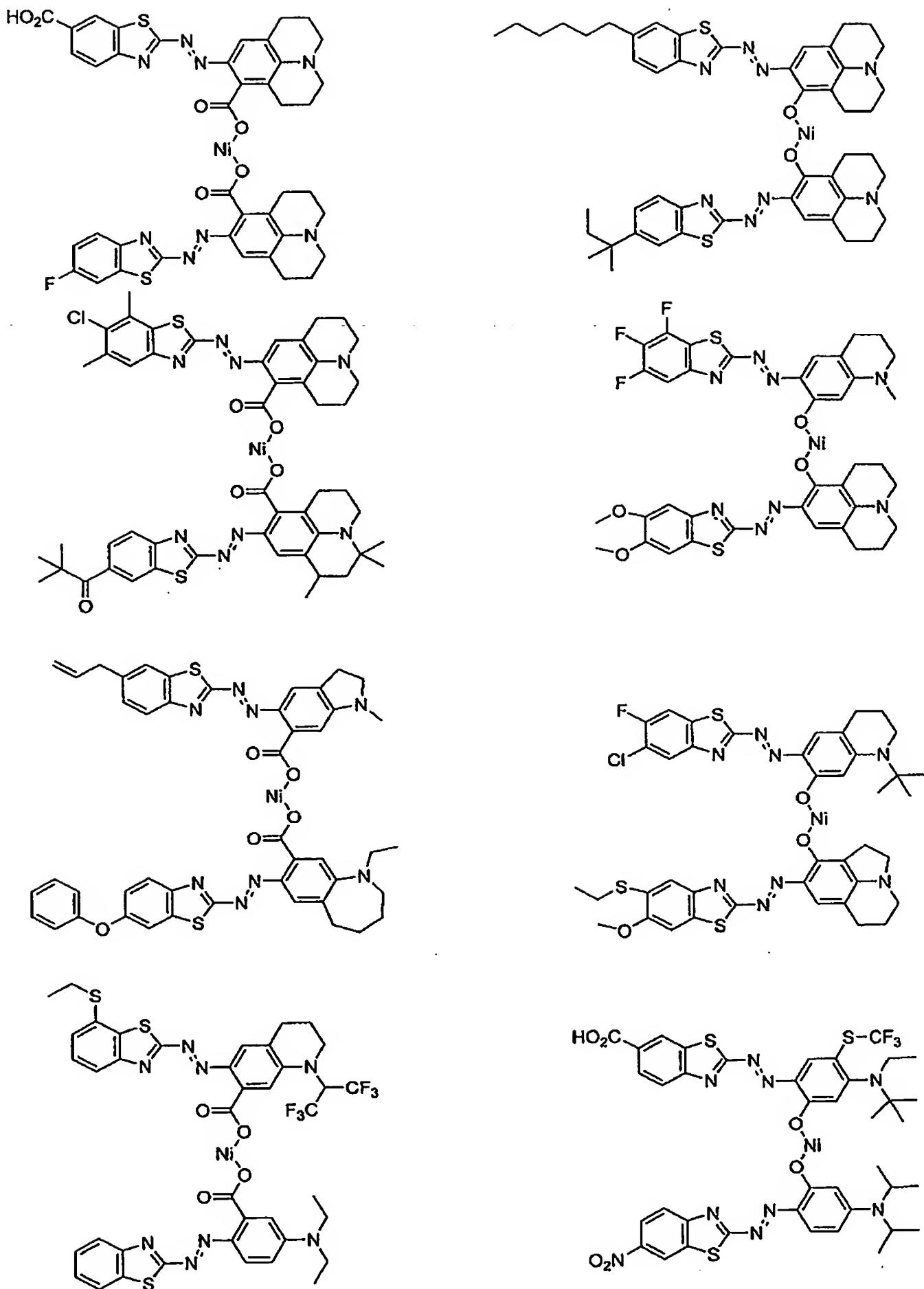
[0044]

[Ka 16]



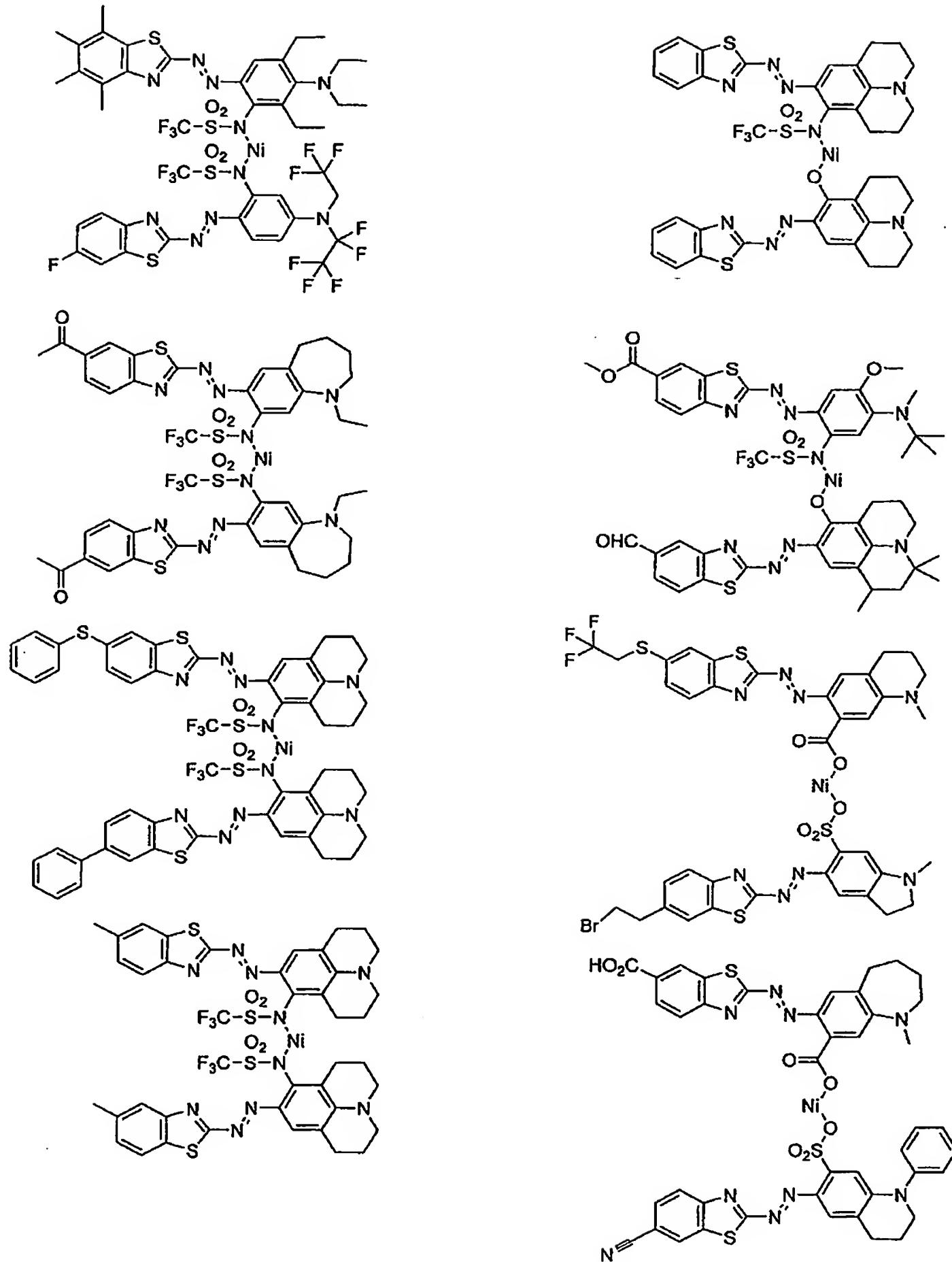
[0045]

[Ka 17]



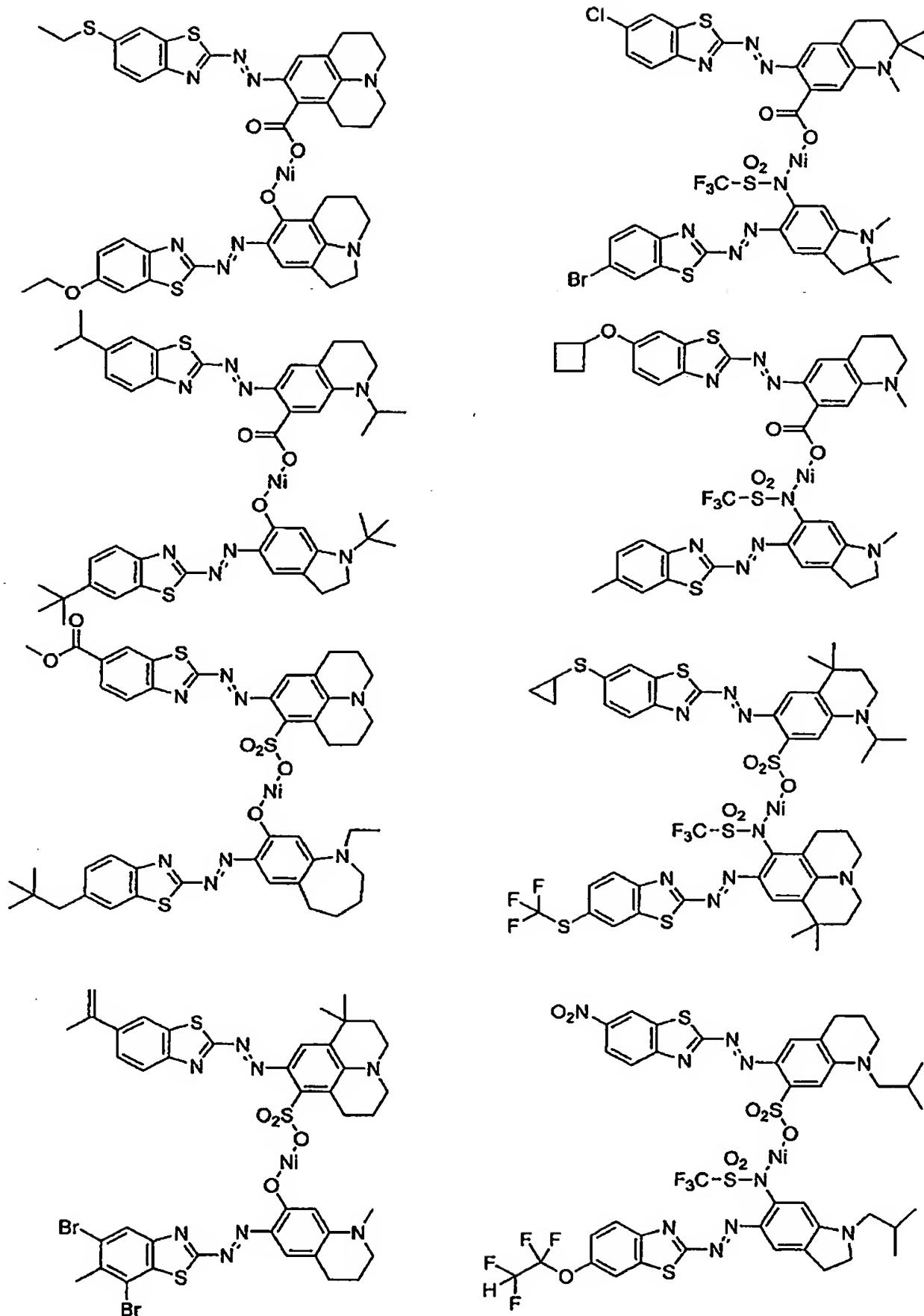
[0046]

[Ka 18]



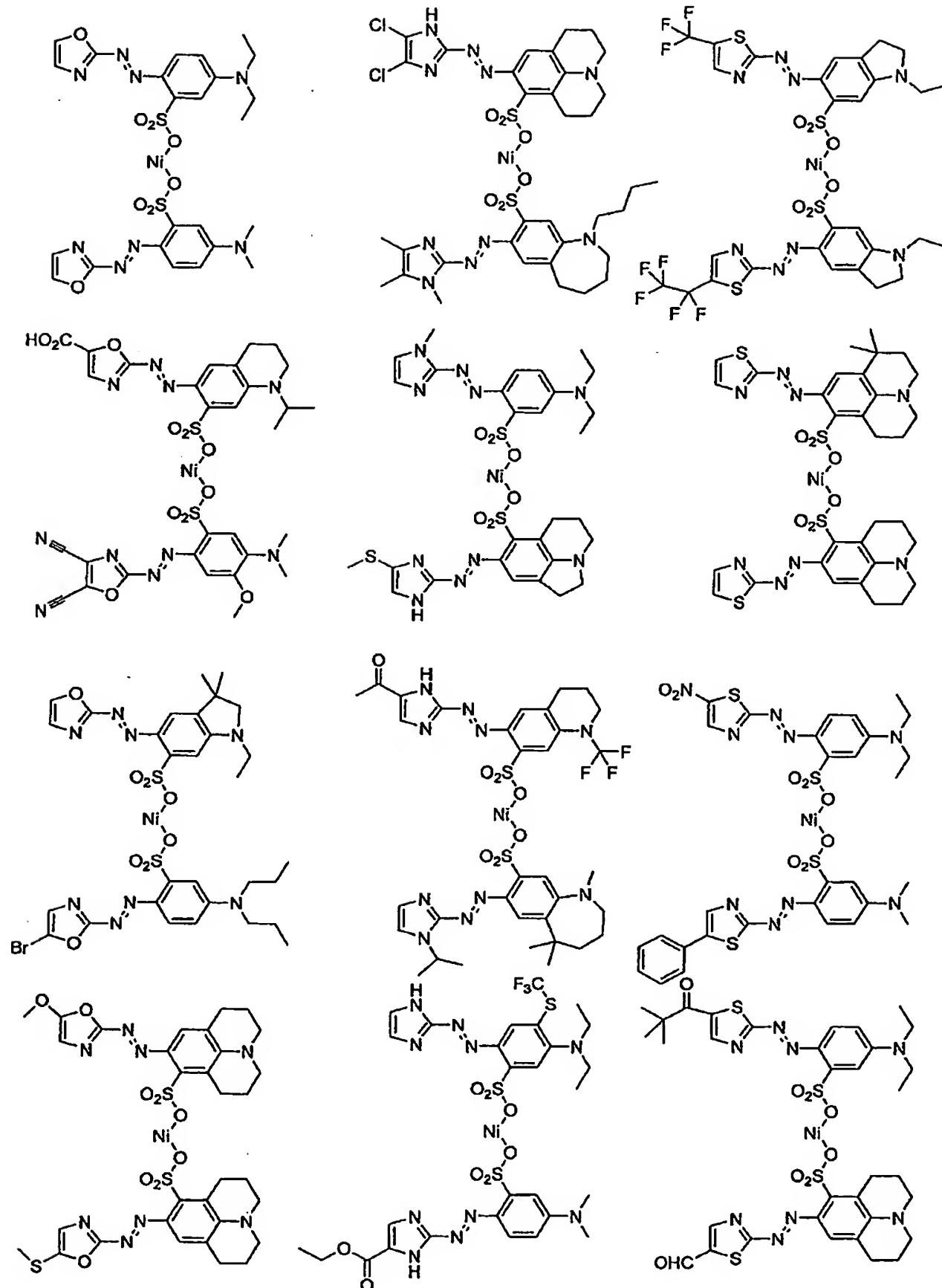
[0047]

[Ka 19]



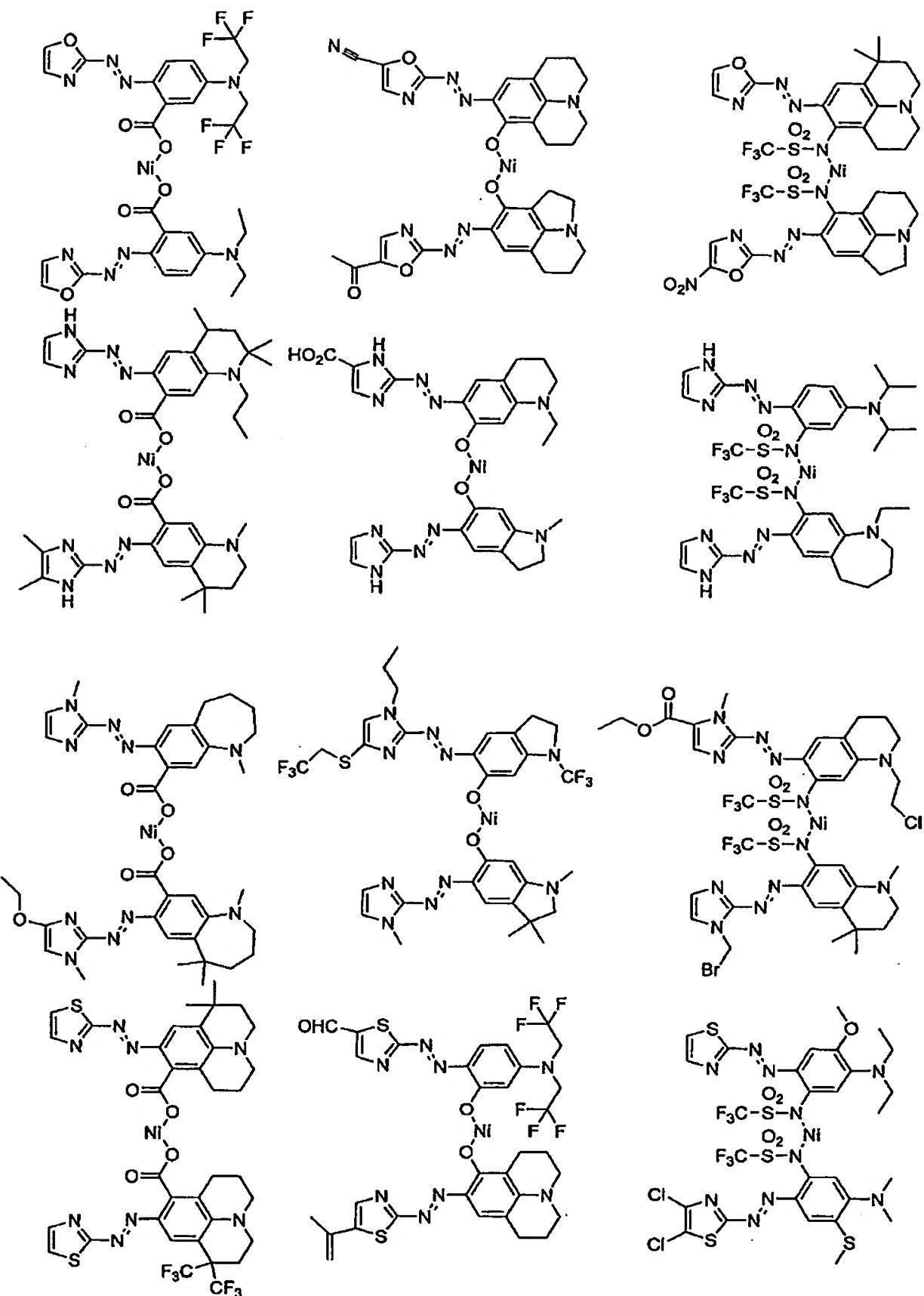
[0048]

[Ka 20]



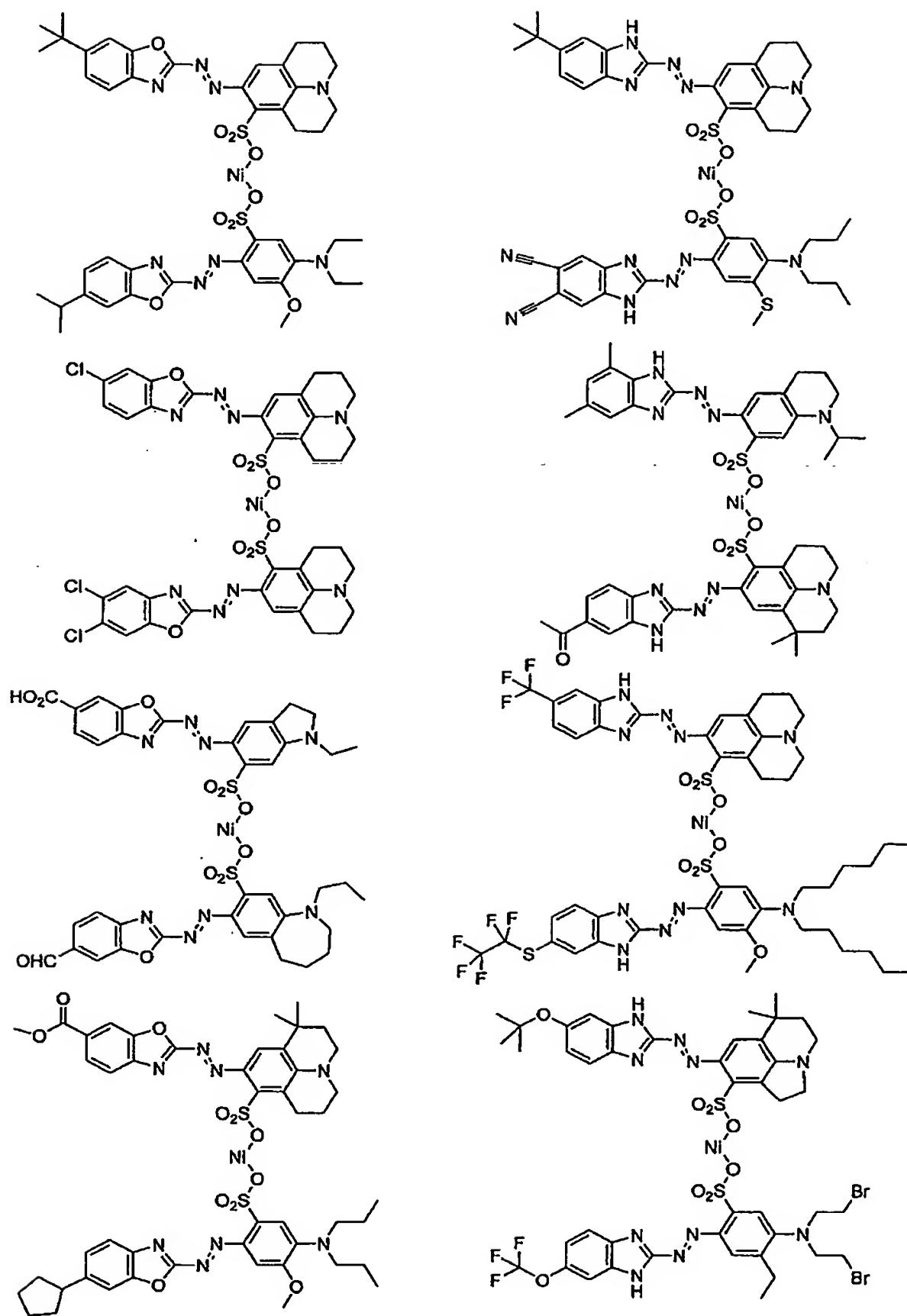
[0049]

[Ka 21]



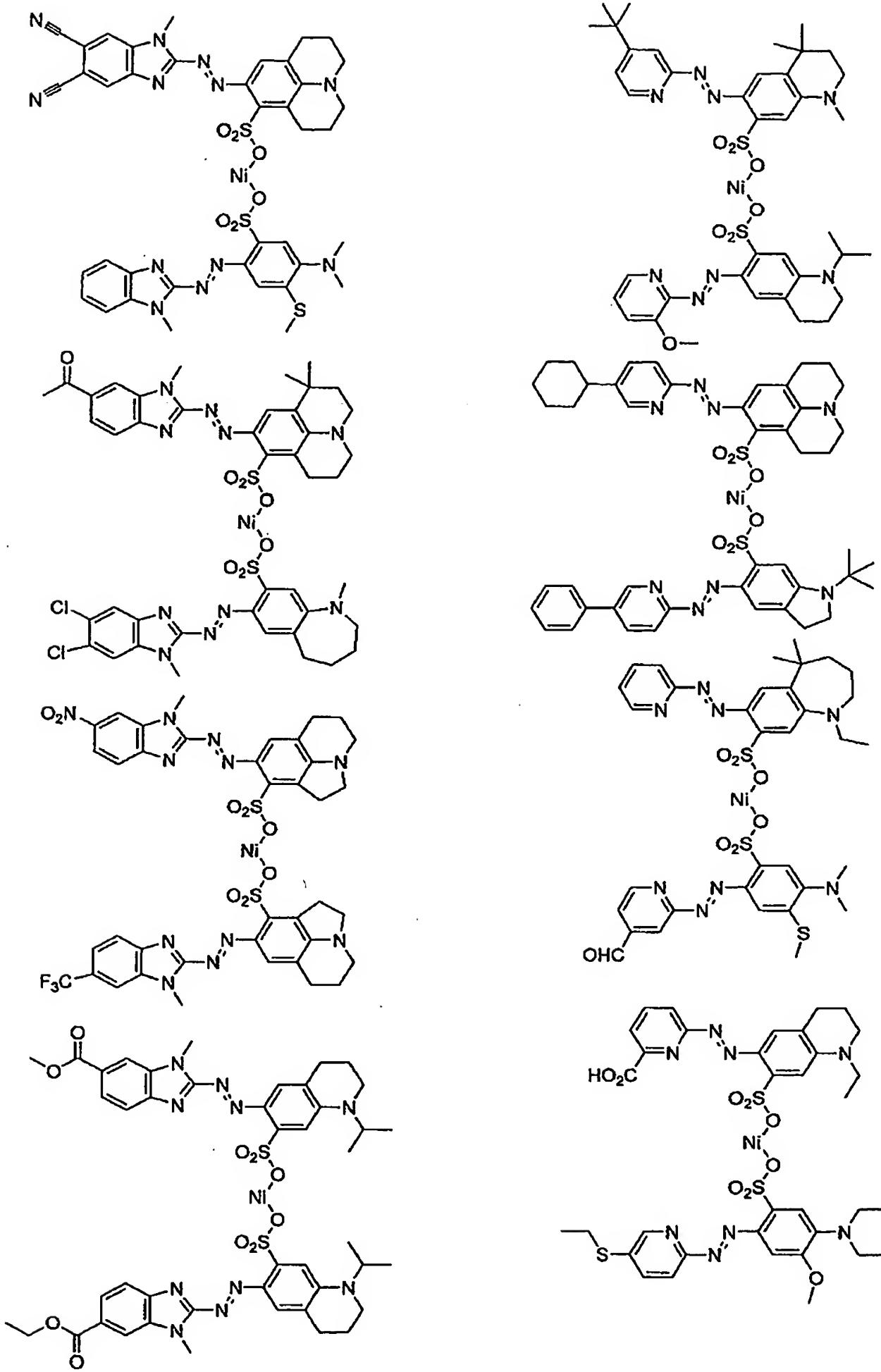
[0050]

[Ka 22]



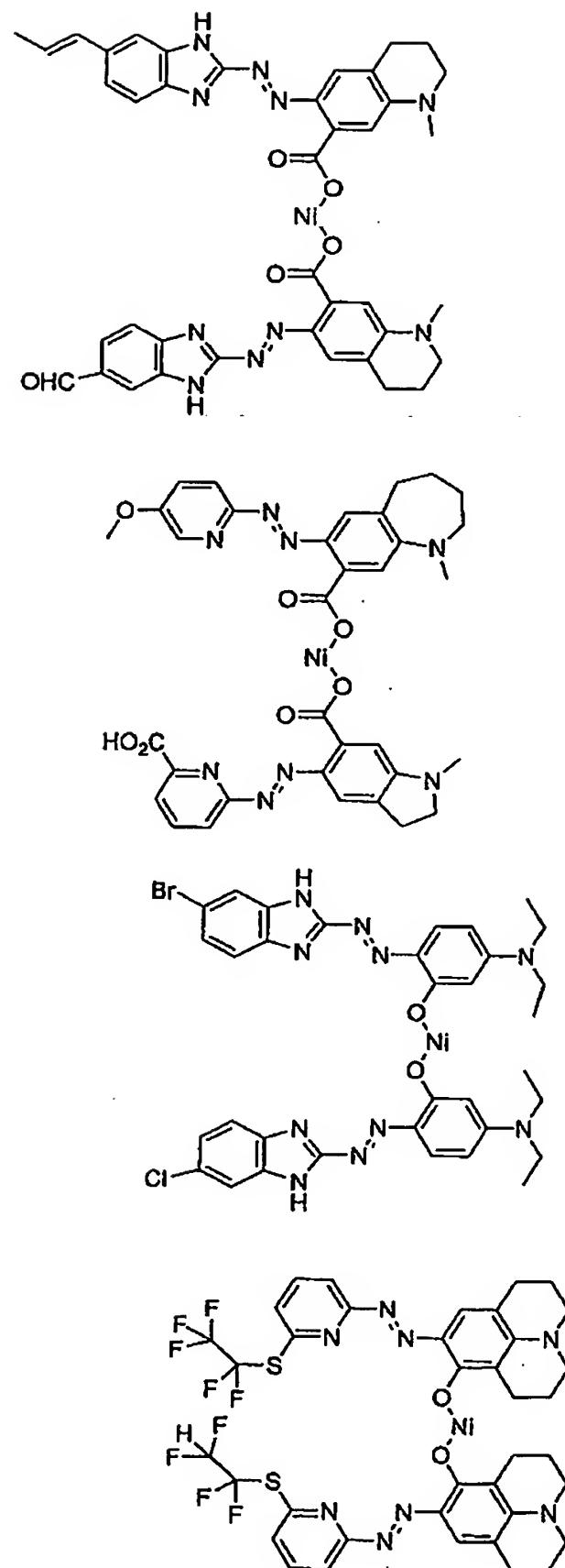
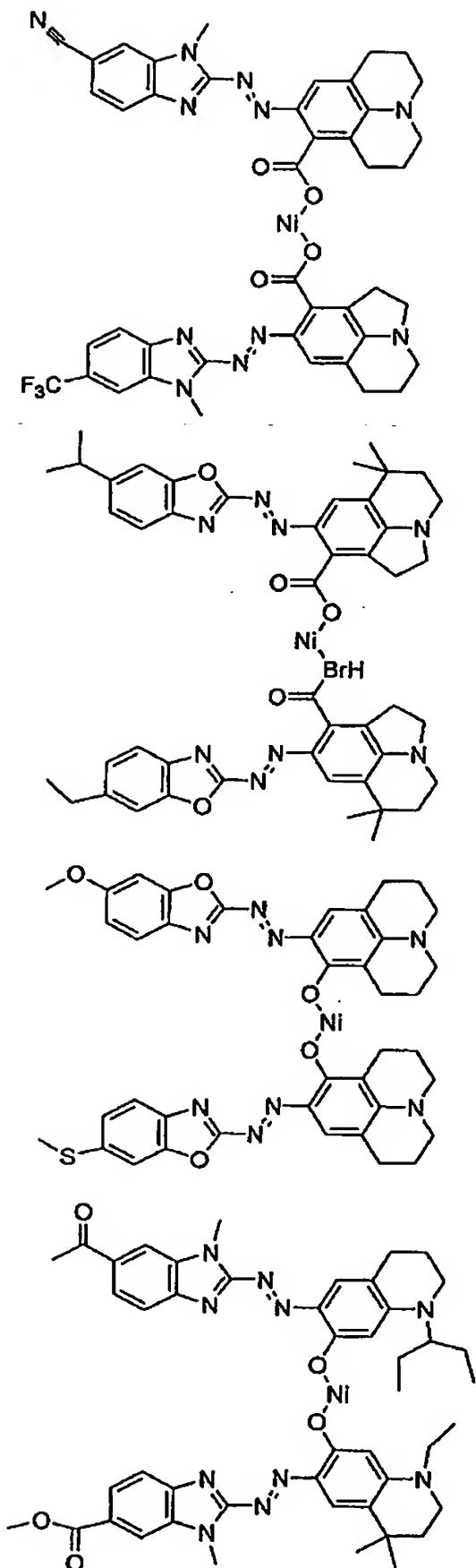
[0051]

[Ka 23]



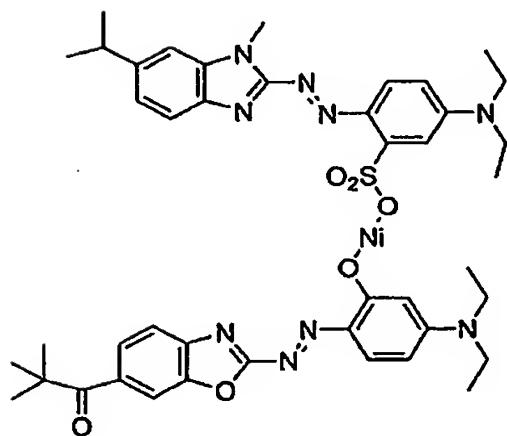
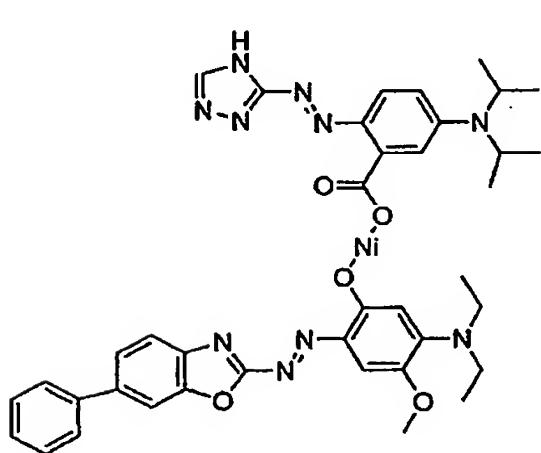
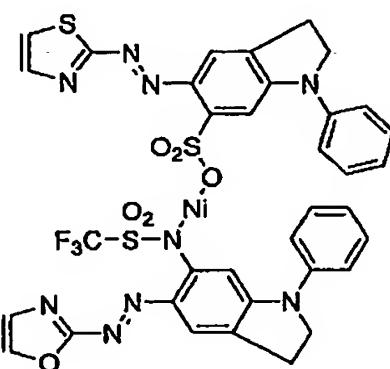
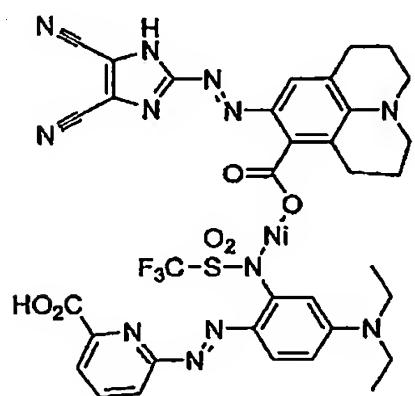
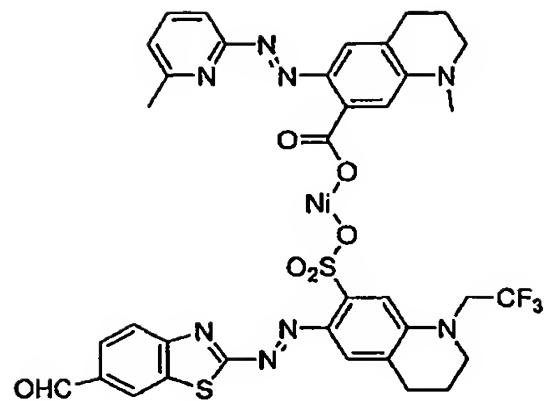
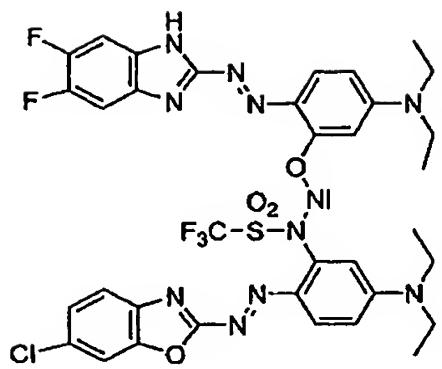
[0052]

[Ka 24]



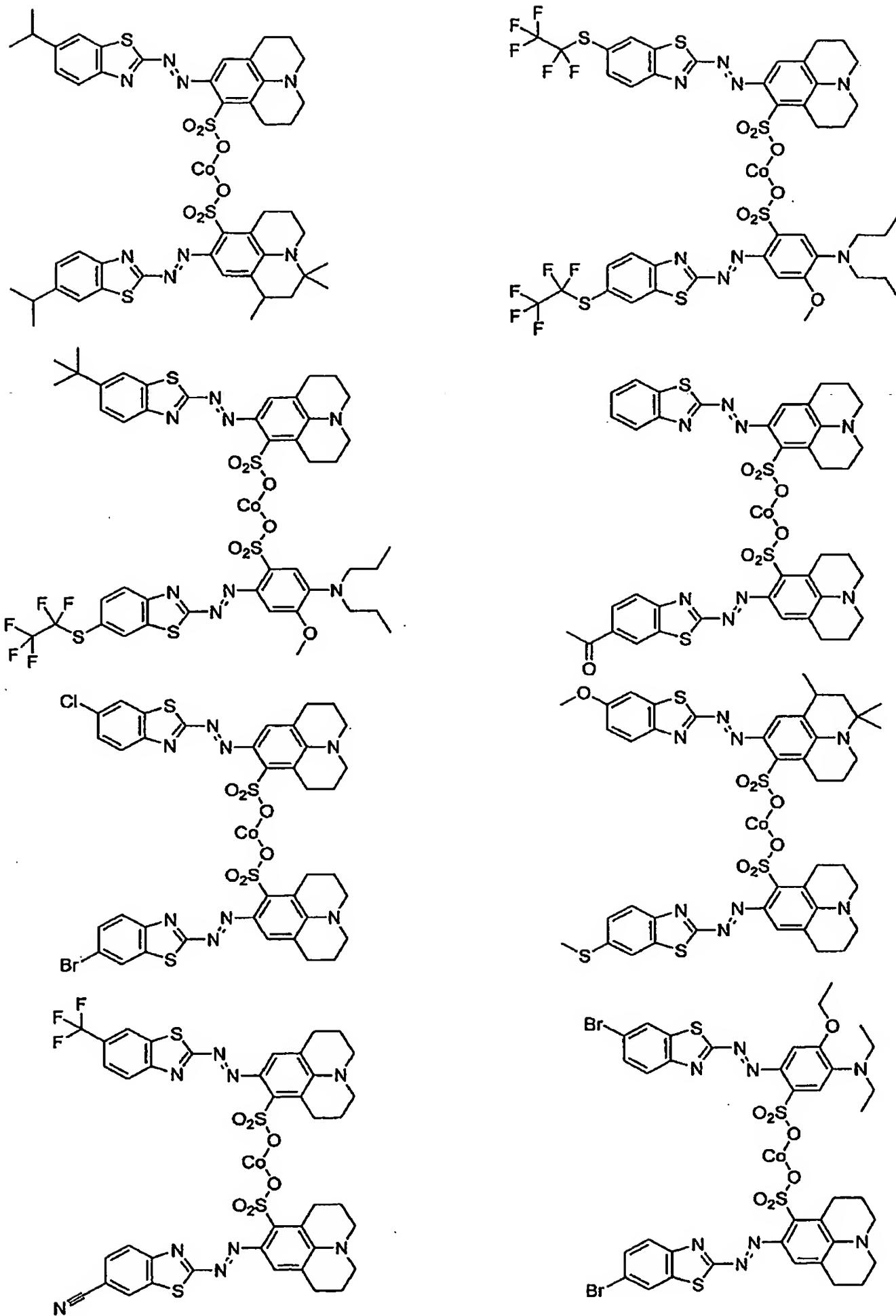
[0053]

[Ka 25]



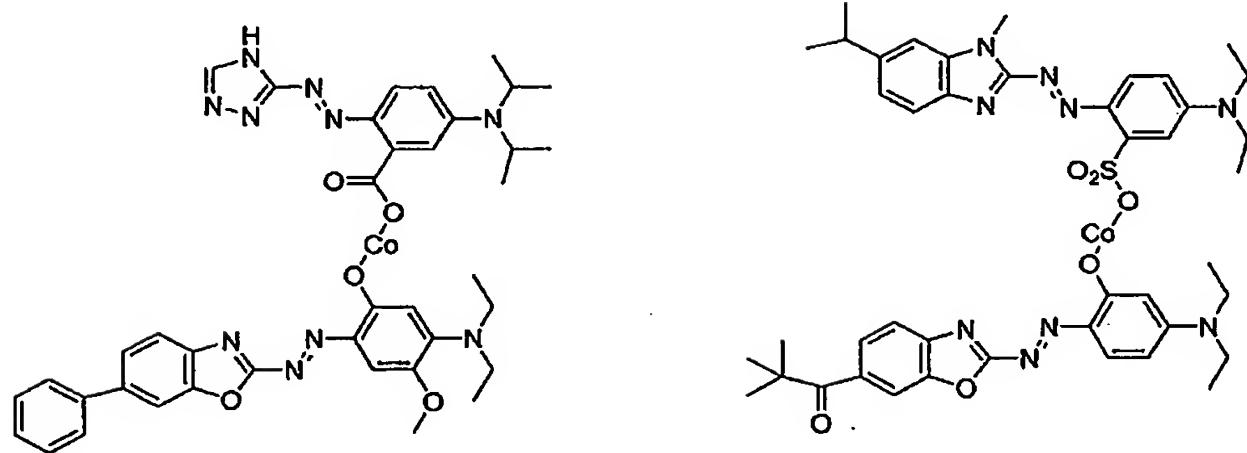
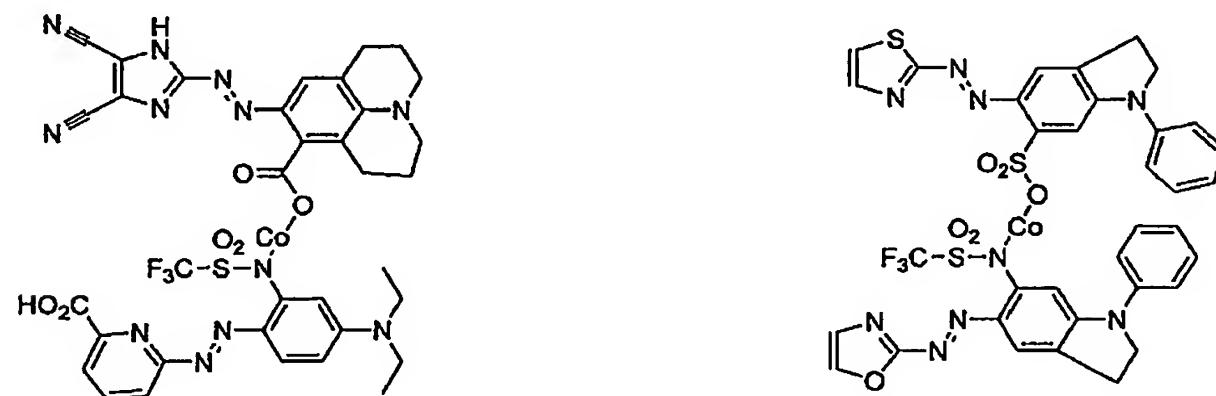
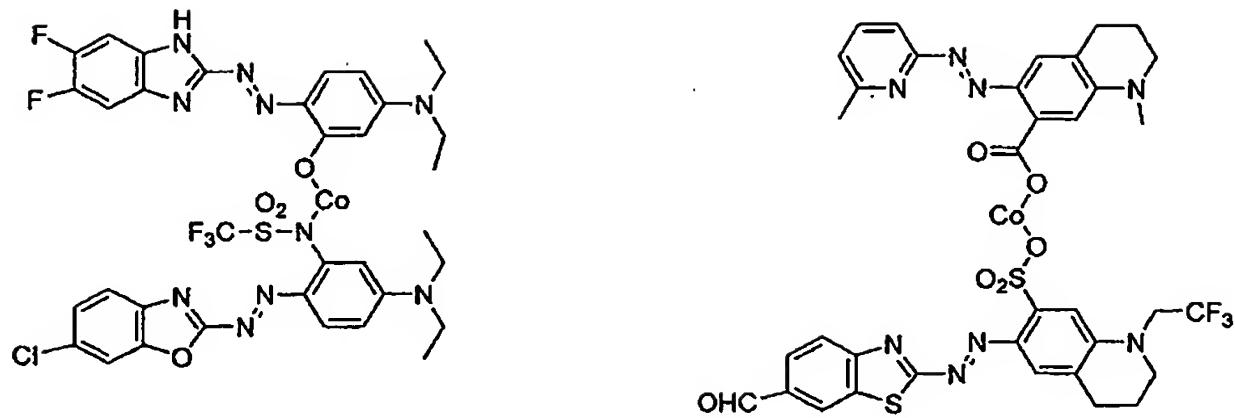
[0054]

[Ka 26]



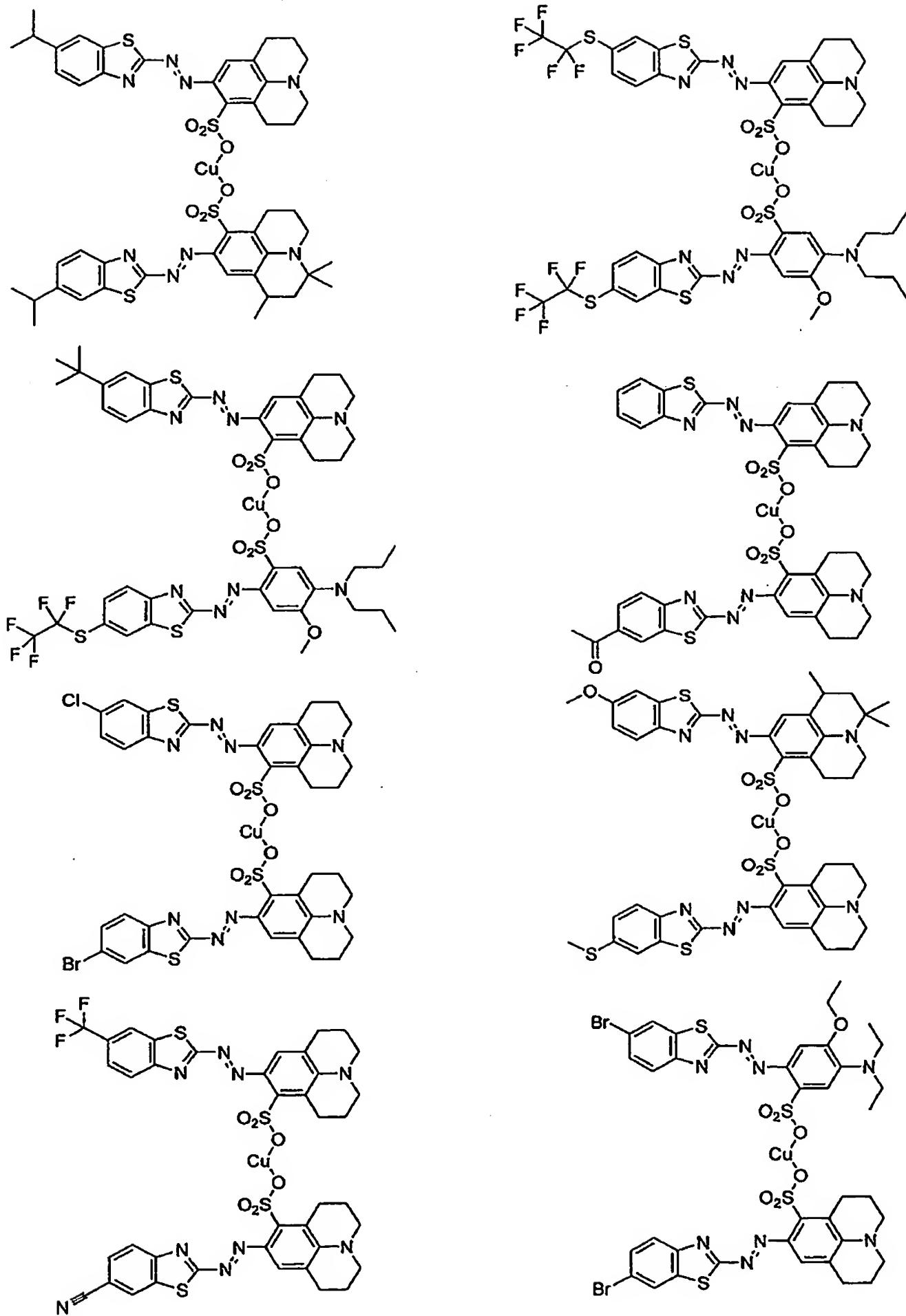
[0055]

[Ka 27]



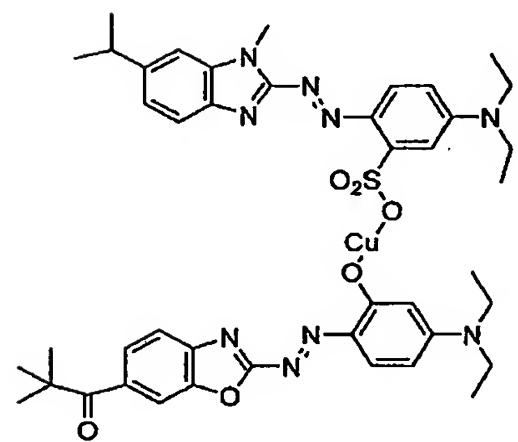
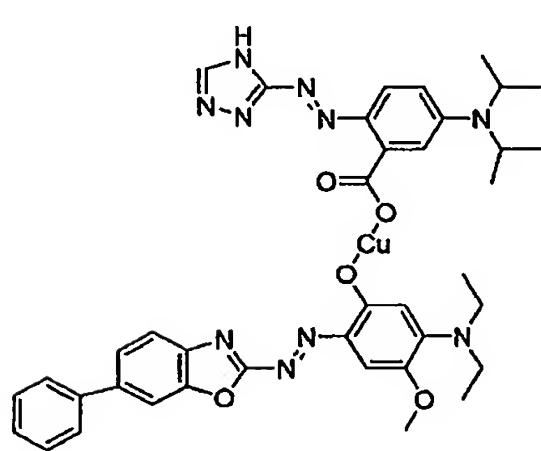
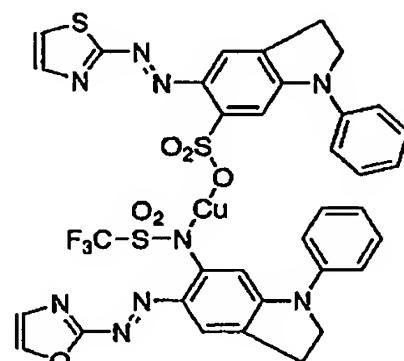
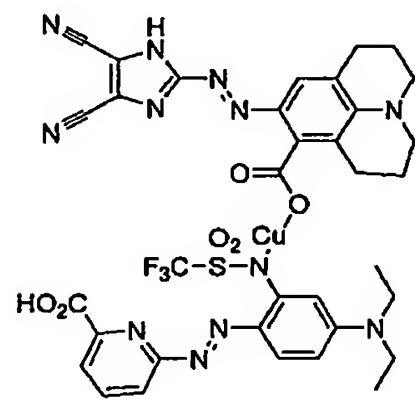
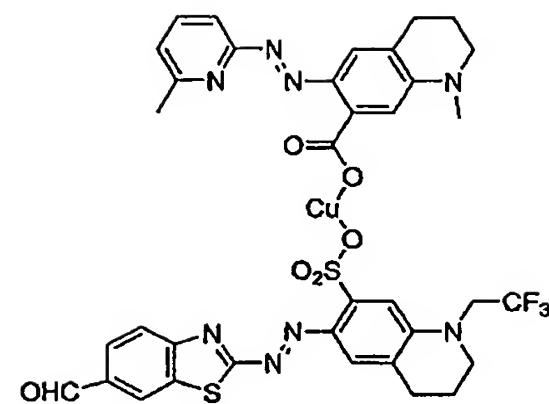
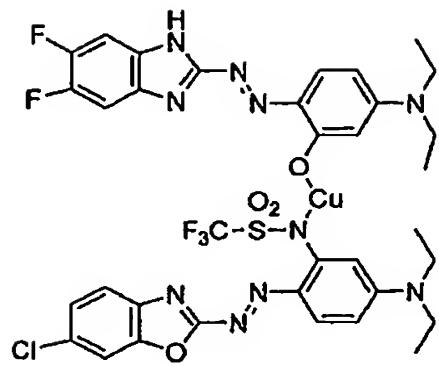
[0056]

[Ka 28]



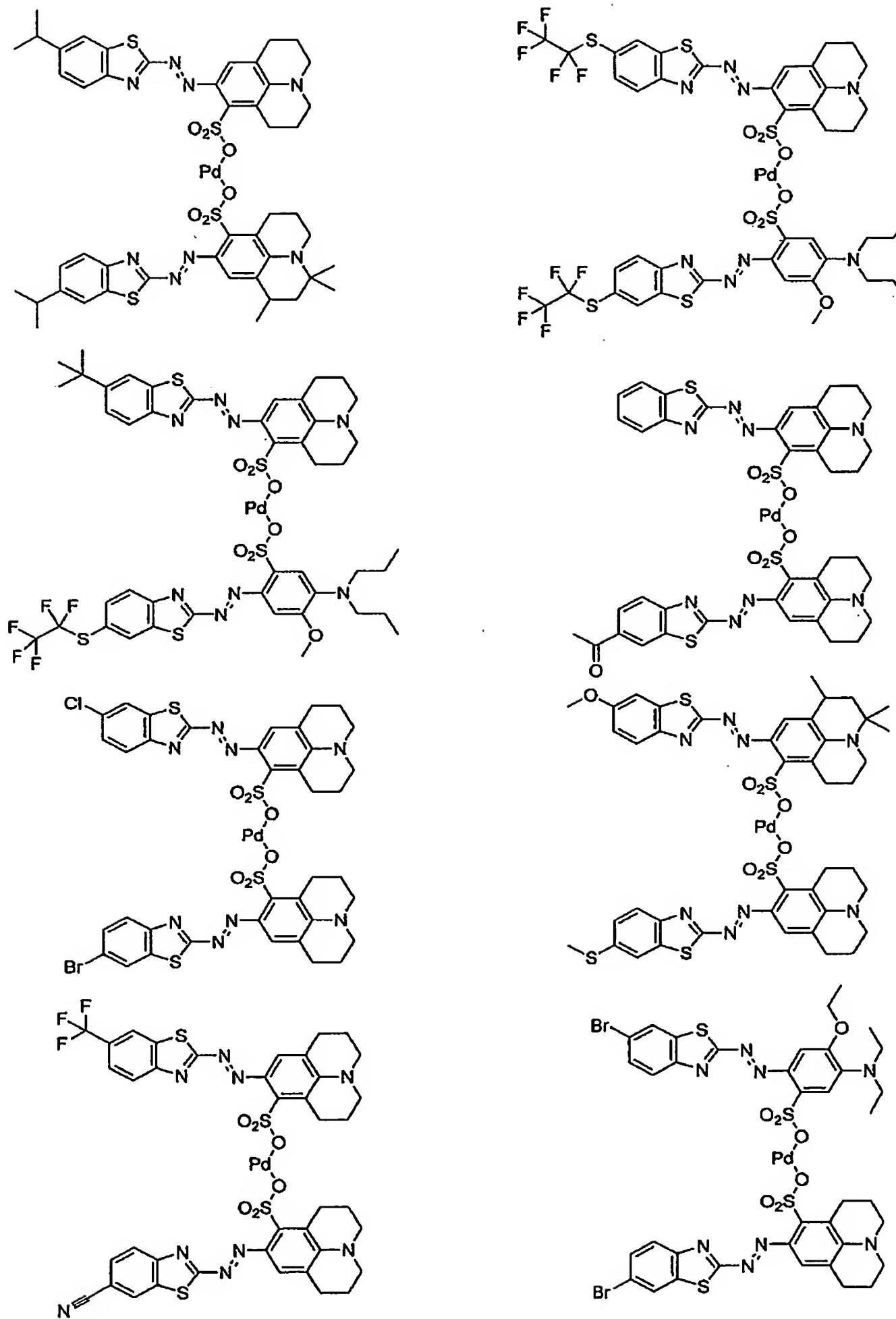
[0057]

[Ka 29]



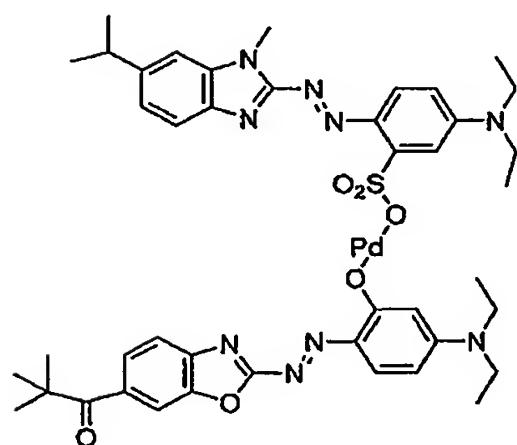
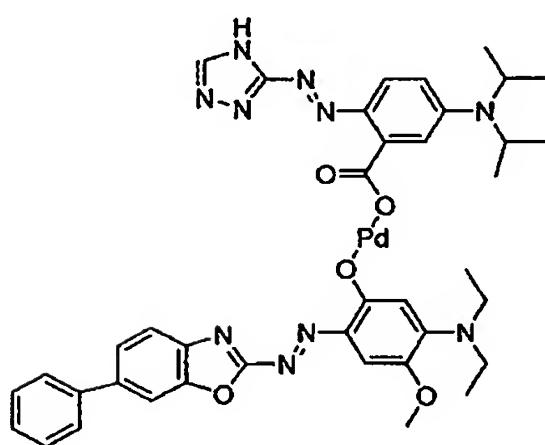
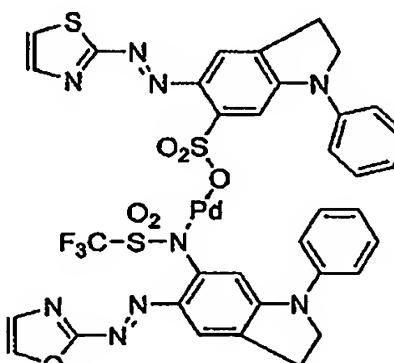
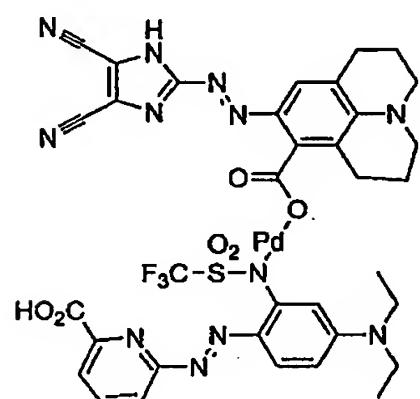
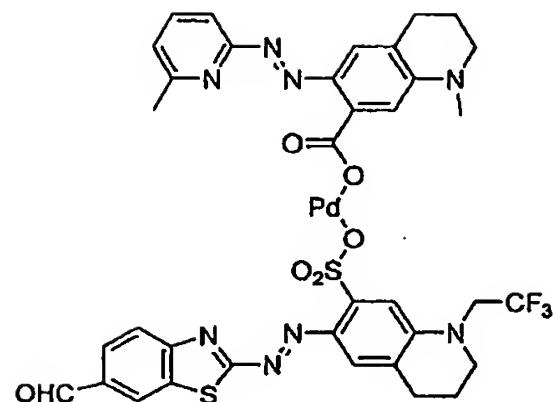
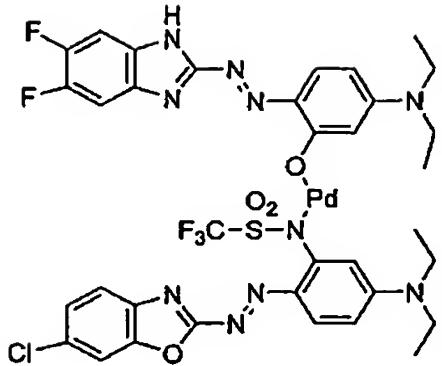
[0058]

[Ka 30]



[0059]

[Ka 31]



[0060]

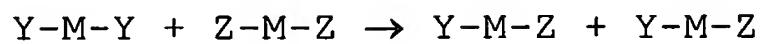
In the present invention, the producing method of a chelate dye comprising two or more azo compounds and a metal which may be divalent or more includes:

Method 1: a method of dissolving chelate dye having azo compounds having the same structure alone as ligands and

chelate dye having azo compounds having the same structure different in structure from the previous azo compounds alone as ligands in an appropriate solvent to perform ligand exchange (scheme 1).

[0061]

[Scheme 1]

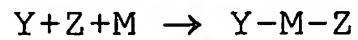


or

Method 2: a method of mixing a plurality of azo compounds to perform a chelation reaction (scheme 2).

[0062]

[Scheme 2]



In the above scheme 1 and scheme 2, the producing methods were described taking a case of using two kinds of chelate dyes each having the same ligands in Method 1 and taking a case of using two kinds of azo compounds in Method 2. However, three or more kinds of the chelate dyes or the azo compounds may be used.

[0063]

The chelate dye obtained by the above method and having a plurality of azo compounds different in structure as ligands can be purified by recrystallization or various chromatographic procedures, if necessary.

The optical recording medium of the invention may contain, in the recording layer, a single chelate dye purified by the above known procedure or a mixture of chelate dyes without special purification.

[0064]

The optical recording medium of the invention fundamentally comprises a substrate and a recording layer containing a chelate dye, but a subbing layer may be provided on the substrate, if necessary. By the way, one example of preferred layer constitution may be a recordable type recording medium having a metal reflecting layer and a protective layer which are successively laminated on the recording layer to form a medium having a high reflectance.

The examples of such a substrate include substrates comprising resins, e.g., acrylate resins, methacrylate resins, polycarbonate resins, polyolefin resins (especially, amorphous polyolefin), polyester resins, polystyrene resins and epoxy resins, substrates comprising glass, and substrates wherein a resin layer comprising a radiation-curable resin such as a photo-curable resin is provided on glass.

Injection molded polycarbonate is preferred in view of high productivity, cost and moisture absorption resistance.

[0065]

An amorphous polyolefin is preferred in view of chemical resistance and moisture absorption resistance.

A glass substrate is preferred in view of high-speed responsibility.

A resin substrate or a resin layer may be provided in contiguous to a recording layer and guide grooves and pits for the recording/reproduction light may be provided on the resin substrate or the resin layer.

The film thickness of the recording layer containing an azo metal chelate dye comprising azo compounds and a metal in the optical recording medium of the invention is from 10 to 5000 nm, preferably from 70 to 3000 nm.

[0066]

A dye layer can be formed by generally used thin film-forming method, e.g., a vacuum deposition method, a sputtering method, a doctor blade method, a cast method, a spinner method and an immersion method, but a spinner method is preferred from the viewpoint of mass production and an economical aspect.

A binder may be used, if necessary. A well-known binder, e.g., polyvinyl alcohol, polyvinyl pyrrolidone, a ketone resin, nitrocellulose, cellulose acetate, polyvinyl butyral, polycarbonate can be used as the binder. In this case, it is preferred that the azo metal chelate dye of the

invention is contained in the binder in an amount of 10 wt% or more.

[0067]

When the layer is formed by a spinner method, the number of revolution is preferably from 500 to 15000 rpm, and treatment such as heating or application of solvent vapor may be performed after spin coating according to circumstances.

For improving the stability and light fastness of the azo metal chelate dye comprising azo compounds and a metal in the optical recording medium of the invention, a transition metal chelate compound (e.g., acetylacetone chelate, bisphenyldithiol, salicylaldehyde oxime, bisdithio- α -diketone) or the like may be contained in a recording layer as a singlet oxygen quencher, and a recording sensitivity improving agent, such as a metal compound, may be contained for improving recording sensitivity. The metal compound herein is a compound containing a metal such as a transition metal in the form of atom, ion or cluster, and the examples thereof include organic metal compounds, e.g., ethylenediamine complex, azomethine complex, phenylhydroxylamine complex, phenanthroline complex, dihydroxyazobenzene complex, dioxime complex, nitrosoaminophenol complex, pyridyltriazine complex, acetylacetone complex,

metallocene complex, and porphyrin complex. The metal atom is not particularly restricted but a transition metal is preferred.

[0068]

The recording layer of the optical recording medium of the invention may contain other kind of dye in addition to the azo metal chelate dye described in the invention. The other dyes include triarylmethane dyes, azo dyes, cyanine dyes, squarylium dyes, and metal-containing indoaniline dyes, phthalocyanine dyes and the like.

When a recording layer is formed by coating according to a doctor blade method, a cast method, a spinner method or an immersion method, in particular, a spinner method, solvent for coating is not particularly limited as long as they do not damage the substrate. The examples include ketone alcohol solvents, e.g., diacetone alcohol, and 3-hydroxy-3-methyl-2-butanone, cellosolve solvents, e.g., methyl cellosolve and ethyl cellosolve, hydrocarbon solvents, e.g., n-hexane and n-octane, hydrocarbon solvents, e.g., cyclohexane, methylcyclohexane, ethylcyclohexane, dimethylcyclohexane, n-butylcyclohexane, tert-butylcyclohexane, and cyclooctane, ether solvents, e.g., diisopropyl ether and dibutyl ether, perfluoroalkyl alcohol solvents, e.g., tetrafluoropropanol and

octafluoropentanol, and hydroxy ester solvents, e.g., methyl lactate, ethyl lactate, and methyl isobutyrate can be used.

[0069]

The recording layer of the optical recording medium of the invention may be provided on both sides or either one side of the substrate. A substrate may further be adhered to the reflecting layer side. Furthermore, two optical recording media may be adhered by opposing reflecting layers mutually as inner surface. A UV-curable resin layer and an inorganic thin layer may be provided on the specular side of the substrate for the purpose of surface protection and prevention of dusts from adhering.

[0070]

A print-receiving layer capable of writing (printing) with various printers, such as an ink jet printer and a heat-sensitive transfer printer, or with various writing tools may be provided on the side which is not the plane of incidence of the recording/reproduction light.

Recording on the thus-obtained optical recording medium is performed by applying laser beam, preferably semiconductor laser beam, converged into 100 nm or so to the recording layer provided on both sides or one side of the substrate. At the part irradiated with laser beam,

thermal deformation of the recording layer, e.g., decomposition, heat evolution or fusion occurs owing to the absorption of laser beam energy.

[0071]

The reproduction of the recorded data is effected by reading the difference in reflectance between the part where thermal deformation has occurred and the part where thermal deformation has not occurred.

The laser beams which are used for the optical recording medium of the invention include N₂, He-Cd, Ar, He-Ne, ruby, semiconductor, and dye lasers. A semiconductor laser is particularly preferred due to its light weight, easy handling property and compactness.

[0072]

[Examples]

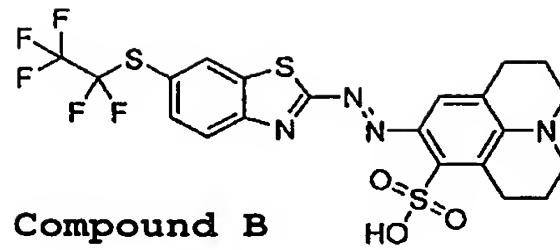
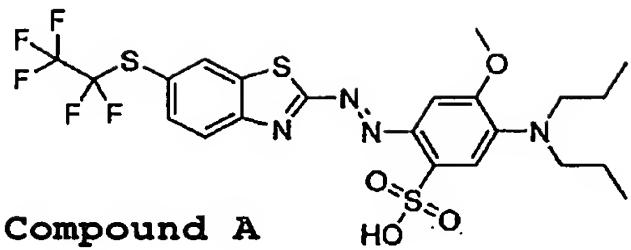
The present invention is specifically described in the following with reference to Examples but they do not limit the invention unless they exceed the gist.

EXAMPLE 1

a) Example of production of compounds

[0073]

[Ka 32]



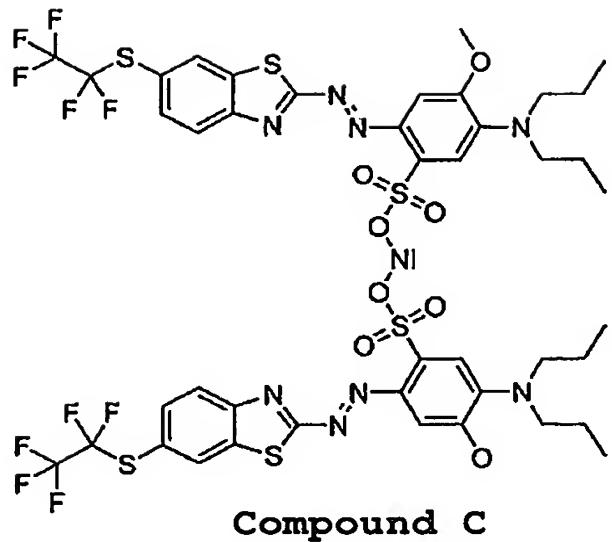
[0074]

Two grams of the compound A and 2 g of the compound B were dissolved in 200 ml of methanol and insoluble matters were filtered. Then, a solution of 0.4 g of nickel acetate tetrahydrate dissolved in 20 ml of methanol was added dropwise thereto over the period of 5 minutes under stirring at 25°C.

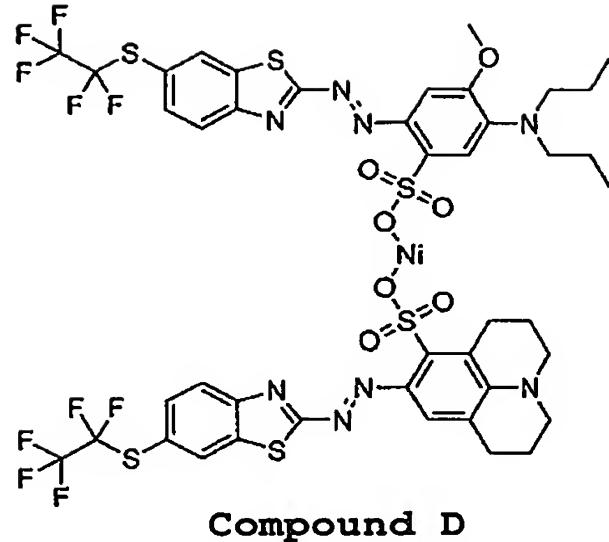
The whole was stirred at 25°C for further 1 hour, the solid formed was filtered and the solid was washed with methanol and dried, whereby a mixture of the compounds represented by the following formulae was obtained.

[0075]

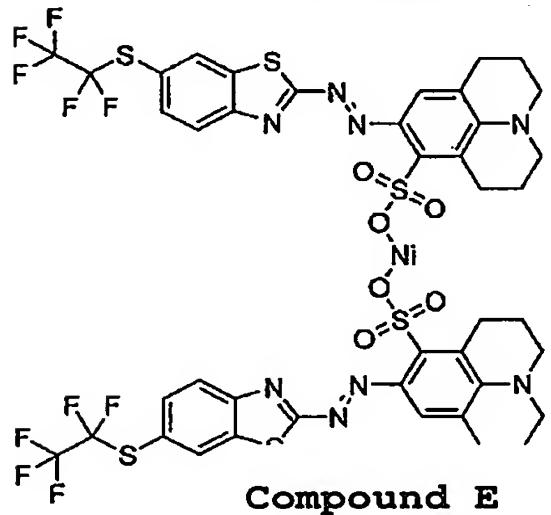
[Ka 33]



Compound C



Compound D



Compound E

[0076]

b) Example of preparation of recording medium

In 10 ml of octafluoropentanol was dissolved 0.3 g of the mixture of compounds C, D and E, and the solution was filtered through a filter having a pore diameter of 220 nm, whereby a dye solution was obtained.

On an injection molded polycarbonate resin substrate (diameter: 12 cm) on which guide grooves had been molded in advance, the dye solution was dripped and coated by a spinner method. After coating, drying was performed

at 80°C for 5 minutes. The maximum absorption wavelength of the coated film was 708 nm.

[0077]

A silver film having a thickness of 1000 Å was formed on the above coated film by a sputtering method to form a reflecting layer. A UV-curable resin was further coated on the reflecting layer by spin coating, and the resin was cured by irradiation with UV ray, whereby a protective layer having a thickness of 5 µm was obtained.

c) Example of evaluation

EFM signals were recorded on the above recording medium by irradiation with laser beam having a central wavelength of 780 nm at a recording power of 9.5 mW under rotating the medium at 5.6 m/s.

[0078]

When the recorded part was then reproduced using a CD player having a central wavelength of 780 nm, good signals were reproduced. The results of the tests of light fastness (xenon fadeometer acceleration test of 20 hours) and storage stability (70°C, 85% RH, 100 hours) of the disc revealed that both sensitivity and recording characteristics were not deteriorated as compared with those at initial stage, and the disc was extremely excellent as the optical recording medium.

EXAMPLE 2

b) Example of preparation of recording medium

An optical recording medium was prepared in the same manner as in Example 1 (b) except that a dye solution obtained by dissolving 0.15 g of the above compound C and 0.15 g of the compound E (both were chelate dyes) in 10 ml of octafluoropentanol and filtering the solution through a filter was used.

c) Example of evaluation

EFM signals were recorded on the above recording medium by irradiation with laser beam having a central wavelength of 780 nm at a recording power of 9.5 mW under rotating the medium at 5.6 m/s.

[0079]

When the recorded part was then reproduced using a CD player having a central wavelength of 780 nm, good signals were reproduced. As a result of the tests of light fastness (xenon fadeometer acceleration test of 20 hours) and storage stability (70°C, 85% RH, 100 hours) of the disc, it was revealed that both sensitivity and recording characteristics were not deteriorated as compared with those at initial stage, and the disc was extremely excellent as the optical recording medium.

COMPARATIVE EXAMPLE 1

b) Example of preparation of recording medium

An optical recording medium was prepared in the same manner as in Example 1 (b) except that a dye solution obtained by dissolving 0.3 g of the compound C in 10 ml of octafluoropentanol and filtering the solution through a filter was used.

c) Example of evaluation

EFM signals were recorded on the above recording medium by irradiation with laser beam having a central wavelength of 780 nm at a recording power of 9.5 mW under rotating the medium at 5.6 m/s.

[0080]

When the recorded part was then reproduced using a CD player having a central wavelength of 780 nm, signals could not be read out.

Furthermore, EFM signals were recorded on the above recording medium by irradiation with laser beam having a central wavelength of 780 nm at a recording power of 12.5 mW under rotating the recording medium at 5.6 m/s. When the recorded part was then reproduced using a CD player having a central wavelength of 780 nm, good signals were reproduced.

[0081]

In optical recording example (c) in Examples 1 and 2, good recording is feasible even at a lower recording power than in Comparative Example 1, and thus it is revealed that the optical recording media using the dyes of the present invention exhibit a high sensitivity and is suitable for a high-speed recording.

COMPARATIVE EXAMPLE 2

b) Example of preparation of recording medium

An optical recording medium was prepared in the same manner as in Example 1 (b) except that a dye solution obtained by dissolving 0.3 g of the compound E in 10 ml of octafluoropentanol and filtering the solution through a filter was used.

c) Example of evaluation

EFM signals were recorded on the above recording medium by irradiation with laser beam having a central wavelength of 780 nm at a recording power of 9.5 mW under rotating the medium at 5.6 m/s.

[0082]

When the recorded part was then reproduced using a CD player having a central wavelength of 780 nm, good signals were reproduced. As a result of the tests of light fastness (xenon fadeometer acceleration test of 20 hours) and storage stability (70°C, 85% RH, 100 hours) of the disc, it was revealed that both sensitivity and recording

characteristics were markedly deteriorated as compared with those at initial stage, and recording and reproduction were impossible.

[0083]

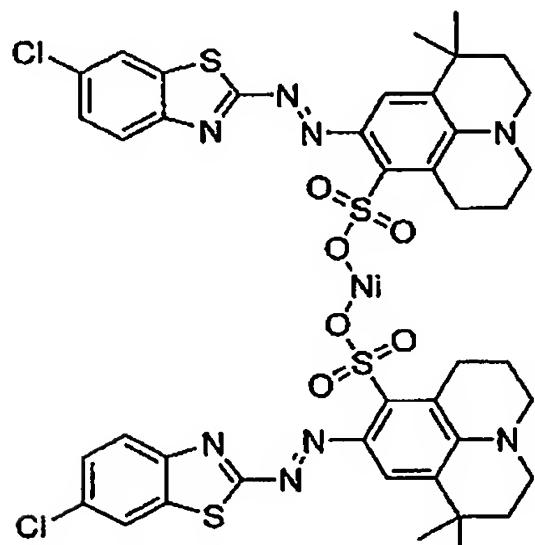
The optical recording media in Examples 1 and 2 are superior to the medium in Comparative Example 2 in light fastness and storage stability, so that it is revealed that they are excellent as the optical recording medium.

EXAMPLE 3

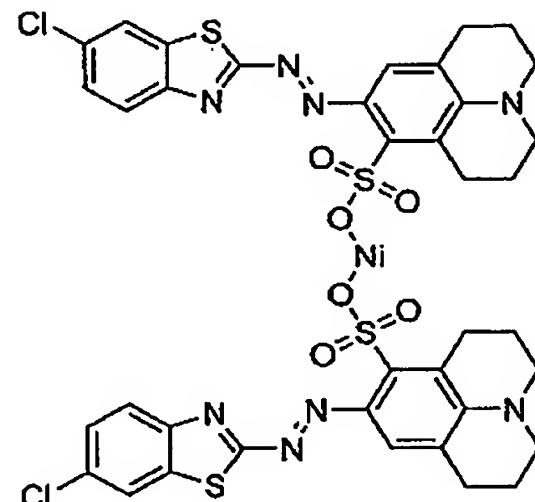
b) Example of preparation of recording medium

[0084]

[Ka 34]



Compound F



Compound G

[0085]

An optical recording medium was prepared in the same manner as in Example 1 (b) except that a dye solution obtained by dissolving 0.15 g of the above compound F and 0.15 g of the compound G (both were chelate dyes) in 10 ml of octafluoropentanol and filtering the solution through a filter was used. The maximum absorption wavelength of the coated film was 715 nm.

c) Example of evaluation

EFM signals were recorded on the above recording medium by irradiation with laser beam having a central wavelength of 780 nm at a recording power of 12.5 mW under rotating the medium at 5.6 m/s.

[0086]

When the recorded part was then reproduced using a CD player having a central wavelength of 780 nm, good signals were reproduced.

COMPARATIVE EXAMPLE 3

b) Example of preparation of recording medium

An optical recording medium was prepared in the same manner as in Example 1 (b), except for the following. That is, 0.3 g of the above compound F was dissolved in 10 ml of octafluoropentanol but the compound was not completely dissolved since the solubility was low, so that the dye which remained undissolved was filtered through a filter, and the thus-obtained dye solution was used.

c) Example of evaluation

EFM signals were recorded on the above recording medium by irradiation with laser beam having a central wavelength of 780 nm at a recording power of 12.5 mW under rotating the medium at 5.6 m/s.

[0087]

When the recorded part was then reproduced using a CD player having central wavelength of 780 nm, signals could not be read out.

COMPARATIVE EXAMPLE 4

b) Example of preparation of recording medium

An optical recording medium was prepared in the same manner as in Example 1 (b), except for the following. That is, 0.3 g of the above compound G was dissolved in 10 ml of octafluoropentanol but the compound was not completely dissolved since the solubility was low, so that the dye which remained undissolved was filtered through a filter, and the thus-obtained dye solution was used.

c) Example of evaluation

EFM signals were recorded on the above recording medium by irradiation with laser beam having a central wavelength of 780 nm at a recording power of 12.5 mW under rotating the medium at 5.6 m/s.

[0088]

When the recorded part was then reproduced using a CD player having central wavelength of 780 nm, signals could not be read out.

It is revealed that the optical recording medium in Example 3 is superior to those in Comparative Examples 3 and 4.

[0089]

[Advantage of the Invention]

The present invention can provide an optical recording medium excellent in stability and applicable to a high-speed recording which will be increasingly required in future.

[Designation of Document] Abstract

[Abstract]

[Problem]

To provide an optical recording medium which is excellent in recording sensitivity and suitable for high-speed recording.

[Means for Resolution]

An optical recording medium comprising a substrate and a laser-writable and/or readable recording layer provided thereon, wherein said recording layer contains a chelate dye comprising two or more azo compounds represented by the following general formula (I) or (II) and a divalent or more metal ion.

[Selected Drawing] None

(ii) The nature of any changes to the specification or claims that would result from entry of the preliminary amendment.

(2) A preliminary amendment will not be disapproved if it is filed no later than:

(i) Three months from the filing date of an application under § 1.53(b);

(ii) The filing date of a continued prosecution application under § 1.53(d); or

(iii) Three months from the date the national stage is entered as set forth in § 1.491 in an international application.

(c) The time periods specified in paragraph (b)(2) of this section are not extendable.

[46 FR 29183, May 29, 1981; removed and reserved, 62 FR 53131, Oct. 10, 1997, effective Dec. 1, 1997; added, 65 FR 54604, Sept. 8, 2000, effective Nov. 7, 2000]

§ 1.116 Amendments after final action or appeal.

(a) An amendment after final action or appeal must comply with § 1.114 or this section.

(b) After a final rejection or other final action (§ 1.113) in an application or in an *ex parte* reexamination filed under § 1.510, or an action closing prosecution (§ 1.949) in an *inter partes* reexamination filed under § 1.913, amendments may be made canceling claims or complying with any requirement of form expressly set forth in a previous Office action. Amendments presenting rejected claims in better form for consideration on appeal may be admitted. The admission of, or refusal to admit, any amendment after a final rejection, a final action, an action closing prosecution, or any related proceedings will not operate to relieve the application or patent under reexamination from its condition as subject to appeal or to save the application from abandonment under § 1.135, or the reexamination from termination. No amendment can be made in an *inter partes* reexamination proceeding after the right of appeal notice under § 1.953 except as provided for in paragraph (d) of this section.

(c) If amendments touching the merits of the application or patent under reexamination are presented after final rejection, or after appeal has been taken, or when such amendment might not otherwise be proper, they may be admitted upon a showing of good and sufficient reasons why they are necessary and were not earlier presented.

(d) No amendment can be made as a matter of right in appealed cases. After decision on appeal, amendments can only be made as provided in §§ 1.198 and 1.981, or to carry into effect a recommendation under § 1.196 or § 1.977.

[24 FR 10332, Dec. 22, 1959; 46 FR 29183, May 29, 1981; para. (a) revised, 62 FR 53131, Oct. 10, 1997, effective Dec. 1, 1997; revised, 65 FR 14865, Mar. 20, 2000, effective May 29, 2000 (adopted as final, 65 FR 50092, Aug. 16, 2000); paras. (b) and (d) revised, 65 FR 76756, Dec. 7, 2000, effective Feb. 5, 2001]

§ 1.117 [Reserved]

[Removed and reserved, 62 FR 53131, Oct. 10, 1997, effective Dec. 1, 1997]

§ 1.118 [Reserved]

[48 FR 2712, Jan. 20, 1983, effective Feb. 27, 1983; removed and reserved, 62 FR 53131, Oct. 10, 1997, effective Dec. 1, 1997]

§ 1.119 [Reserved]

[32 FR 13583, Sept. 28, 1967; removed and reserved, 62 FR 53131, Oct. 10, 1997, effective Dec. 1, 1997]

§ 1.121 Manner of making amendments in application.

(a) *Amendments in applications, other than reissue applications.* Amendments in applications, other than reissue applications, are made by filing a paper, in compliance with § 1.52, directing that specified amendments be made.

(b) *Specification other than the claims and listings provided for elsewhere (§§ 1.96 and 1.825).*—

(1) *Amendment by instruction to delete, replace, or add a paragraph.* Amendments to the specification, other than the claims and listings provided for elsewhere (§§ 1.96 and 1.825), may be made by submitting:

(i) An instruction, which unambiguously identifies the location, to delete one or more paragraphs of the specification, replace a deleted paragraph with one or more replacement paragraphs, or add one or more paragraphs;

(ii) Any replacement or added paragraph(s) in clean form, that is, without markings to indicate the changes that have been made; and

(iii) Another version of any replacement paragraph(s), on one or more pages separate from the amendment, marked up to show all the changes relative to the previous version of the paragraph(s). The changes may be shown by brackets (for deleted matter) or underlining (for added matter), or by any equivalent marking system. A marked up version does not have to be supplied for an added paragraph or a deleted paragraph as it is sufficient to state that a particular paragraph has been added, or deleted.

(2) *Amendment by replacement section.* If the sections of the specification contain section headings as provided in §§ 1.77(b), 1.154(b), or § 1.163(c), amendments to the specification, other than the claims, may be made by submitting:

(i) A reference to the section heading along with an instruction to delete that section of the specification and to replace such deleted section with a replacement section;

(ii) A replacement section in clean form, that is, without markings to indicate the changes that have been made; and

(iii) Another version of the replacement section, on one or more pages separate from the amendment, marked up to show all changes relative to the previous version of the section. The changes may be shown by brackets (for deleted matter) or underlining (for added matter), or by any equivalent marking system.

(3) *Amendment by substitute specification.* The specification, other than the claims, may also be amended by submitting:

(i) An instruction to replace the specification;

(ii) A substitute specification in compliance with § 1.125(b); and

(iii) Another version of the substitute specification, separate from the substitute specification, marked up to show all changes relative to the previous version of the specification. The changes may be shown by brackets (for deleted matter), or underlining (for added matter), or by any equivalent marking system.

(4) *Reinstatement:* Deleted matter may be reinstated only by a subsequent amendment presenting the previously deleted matter.

(c) *Claims.* —

(1) *Amendment by rewriting, directions to cancel or add.* Amendments to a claim must be made by rewriting such claim with all changes (e.g., additions, deletions, modifications) included. The rewriting of a claim (with the same number) will be construed as directing the cancellation of the previous version of that claim. A claim may also be canceled by an instruction.

(i) A rewritten or newly added claim must be in clean form, that is, without markings to indicate the changes that have been made. A parenthetical expression should follow the claim number indicating the status of the claim as amended or newly added (e.g., "amended," "twice amended," or "new").

(ii) If a claim is amended by rewriting such claim with the same number, the amendment must be accompanied by another version of the rewritten claim, on one or more pages separate from the amendment, marked up to show all the changes relative to the previous version of that claim. A parenthetical expression should follow the claim number indicating the status of the claim, e.g., "amended," "twice amended," etc. The parenthetical expression "amended," "twice amended," etc. should be the same for both the clean version of the claim under paragraph (c)(1)(i) of this section and the marked up version under this paragraph. The changes may be shown by brackets (for deleted matter) or underlining (for added matter), or by any equivalent marking system. A marked up version does not have to be supplied for an added claim or a canceled claim as it is sufficient to state that a particular claim has been added, or canceled.

(2) A claim canceled by amendment (deleted in its entirety) may be reinstated only by a subsequent amendment presenting the claim as a new claim with a new claim number.

(3) A clean version of the entire set of pending claims may be submitted in a single amendment paper. Such a submission shall be construed as directing the cancellation of all previous versions of any pending claims. A marked up version is required only for claims being changed by the current amendment (see paragraph (c)(1)(ii) of this section). Any claim

§ 1.122

MANUAL OF PATENT EXAMINING PROCEDURE

not accompanied by a marked up version will constitute an assertion that it has not been changed relative to the immediate prior version.

(d) *Drawings.* Application drawings are amended in the following manner: Any change to the application drawings must be submitted on a separate paper showing the proposed changes in red for approval by the examiner. Upon approval by the examiner, new drawings in compliance with § 1.84 including the changes must be filed.

(e) *Disclosure consistency.* The disclosure must be amended, when required by the Office, to correct inaccuracies of description and definition, and to secure substantial correspondence between the claims, the remainder of the specification, and the drawings.

(f) *No new matter.* No amendment may introduce new matter into the disclosure of an application.

(g) *Exception for examiner's amendments:* Changes to the specification, including the claims, of an application made by the Office in an examiner's amendment may be made by specific instructions to insert or delete subject matter set forth in the examiner's amendment by identifying the precise point in the specification or the claim(s) where the insertion or deletion is to be made. Compliance with paragraphs (b)(1), (b)(2) or (c)(1) of this section is not required.

(h) *Amendments in reissue applications.* Any amendment to the description and claims in reissue applications must be made in accordance with § 1.173.

(i) *Amendments in reexamination proceedings:* Any proposed amendment to the description and claims in patents involved in reexamination proceedings in both *ex parte* reexaminations filed under § 1.510 and *inter partes* reexaminations filed under § 1.913 must be made in accordance with § 1.530(d)-(j).

(j) *Amendments in provisional applications:* Amendments in provisional applications are not normally made. If an amendment is made to a provisional application, however, it must comply with the provisions of this section. Any amendments to a provisional application shall be placed in the provisional application file but may not be entered.

[32 FR 13583, Sept. 28, 1967; 46 FR 29183, May 29, 1981; para. (e), 49 FR 555, Jan. 4, 1984, effective Apr. 1,

1984; revised, 62 FR 53131, Oct. 10, 1997, effective Dec. 1, 1997; revised, 65 FR 54604, Sept. 8, 2000, effective Nov. 7, 2000; para. (i) revised, 65 FR 76756, Dec. 7, 2000, effective Feb. 5, 2001]

§ 1.122 [Reserved]

[24 FR 10332, Dec. 22, 1959; para. (b), 49 FR 48416, Dec. 12, 1984, effective Feb. 11, 1985; removed and reserved, 62 FR 53131, Oct. 10, 1997, effective Dec. 1, 1997]

§ 1.123 [Reserved]

[48 FR 2712, Jan. 20, 1983, effective Feb. 27, 1983; 49 FR 555, Jan. 4, 1984, effective Apr. 1, 1984; amended, 58 FR 38719, July 20, 1993, effective Oct. 1, 1993; removed and reserved, 62 FR 53131, Oct. 10, 1997, effective Dec. 1, 1997]

§ 1.124 [Reserved]

[Removed and reserved, 62 FR 53131, Oct. 10, 1997, effective Dec. 1, 1997]

§ 1.125 Substitute specification.

(a) If the number or nature of the amendments or the legibility of the application papers renders it difficult to consider the application, or to arrange the papers for printing or copying, the Office may require the entire specification, including the claims, or any part thereof, be rewritten.

(b) A substitute specification, excluding the claims, may be filed at any point up to payment of the issue fee if it is accompanied by:

(1) A statement that the substitute specification includes no new matter; and

(2) A marked up version of the substitute specification showing all the changes (including the matter being added to and the matter being deleted from) to the specification of record. Numbering the paragraphs of the specification of record is not considered a change that must be shown pursuant to this paragraph.

(c) A substitute specification submitted under this section must be submitted in clean form without markings as to amended material. The paragraphs of any substitute specification, other than the claims, should be individually numbered in Arabic numerals